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New Orleans District

REMOTE-SENSING CULTURAL RESOURCES SURVEY OF THE HOUMA NAVIGATION CANAL, DREDGE ISLAND CREATION PROJECT, TERREBONNE PARISH, LOUISIANA

Final Report

2001

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Prepared for:

U. S. Army Corps of Engineers
New Orleans District
(Contract No. DACW29-97-D-0017,
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ATTENTION OF:

28 February 2001

Planning, Programs, and
Project Management Division
Environmental Planning and
Compliance Branch

To The Reader:

This cultural resource effort was designed and guided by the U.S. Army Corps of Engineers, New Orleans District, as part of our cultural resource management program. We concur with the authors' recommendations regarding future cultural resources investigations. The Louisiana State Historic Preservation Officer, the State of Louisiana also concurs with the authors' recommendations.

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In June 2000, a cultural resources, remote-sensing survey was conducted of an approximately 450-acre area located adjacent to the Houma Navigation Canal in Terrebonne Bay in Terrebonne Parish, Louisiana. This area has been selected for the construction of an artificial island habitat using shoal material removed from the adjacent Houma navigation Canal. The survey was conducted to locate and assess significant historic shipwrecks or other underwater cultural resources that may exist in the project area. The remote-sensing survey used a fathometer, a cesium magnetometer and a side-scan sonar and relied on differential GPS positioning. A number of small side-scan sonar targets and magnetic anomalies were recorded during the survey. All of these objects are believed to be modern trash and debris; none are considered to represent significant cultural remains.

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TABLE OF CONTENTS

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In June 2000, a cultural resources, remote-sensing survey was conducted of an approximately 450-acre area located adjacent to the Houma Navigation Canal in Terrebonne Bay in Terrebonne Parish, Louisiana. This area has been selected for the construction of an artificial island habitat using shoal material removed from the adjacent Houma navigation Canal. The survey was conducted to locate and assess significant historic shipwrecks or other underwater cultural resources that may exist in the project area. The remote-sensing survey used a fathometer, a cesium magnetometer and a side-scan sonar and relied on differential GPS positioning. A number of small side-scan sonar targets and magnetic anomalies were recorded during the survey. All of these objects are believed to be modern trash and debris; none are considered to represent significant cultural remains.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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CHAPTER 1

INTRODUCTION

The Project Area

This report presents the results of a marine remote-sensing survey undertaken to locate and assess underwater cultural resources within an approximately 450-acre area located on the west side of the Houma Navigation Canal (HNC) in Terrebonne Bay, in southern Terrebonne Parish, Louisiana (Figure 1-1). The study was undertaken in response to plans by the New Orleans District, U.S. Army Corps of Engineers (NOCOE) to use this area to deposit shoal material excavated from the Houma Navigation Canal in the creation of an island habitat. Shoal material will be removed from the navigation channel during routine maintenance and will be placed in the selected disposal area to a height "conducive to the development of barrier island habitat" (New Orleans District, U.S. Army Corps of Engineers [hereinafter cited NOCOE] 2000). Retention dikes or rock, earth, shell or a combination of the three will be constructed to contain the deposited material. The artificial island will encompass approximately 100 acres and will be built just over 1,000 ft west of the navigation canal. In order to permit barge access to the artificial island locale, a bucket dredge will be used to dig a flotation channel between the navigation canal and the island location. The artificial island, the flotation channel, plus a surrounding buffer zone constitute the 450-acre area examined in this study.

The 450-acre project area is almost square, measuring 4700 ft by 4200 ft in size. The Houma Navigation Canal forms the eastern boundary of the project area and a pipeline right-of-way, containing three pipelines, lies just outside of the northern boundary (Figure 1-1). The bay bottom in the project area is relatively flat and water depths are fairly shallow. Depths average 7 to 8 ft across most of the project area, except along the eastern edge where the bottom slopes down to a depth of about 15 ft, inside of the maintained channel of the Houma Navigation Canal.

The project area represents one of three almost identical artificial island construction projects planned along this section of the HNC. A similar diked disposal area, known as the Bay Chaland Disposal Area, has already been constructed on the north side of the HNC a mile or so north of the present project area (see Figure 1-1).

Terrebonne Bay has been traveled by a variety of watercraft through most of the historic period. Several miles south of the project area are Cat Island Pass and Wine Island Pass, which historically served as navigation routes connecting the Gulf of Mexico with the interior of the central coast of Louisiana. The relatively recent Houma Navigation Canal extends through the most important of these passes, Cat Island Pass. These passes provided access to Terrebonne Bay and to a series of small waterways lying north and west of the project area that were, and still are, regionally important water routes leading inland. The most important of these water routes are Bayou Terrebonne, which enters Terrebonne Bay about 4 m

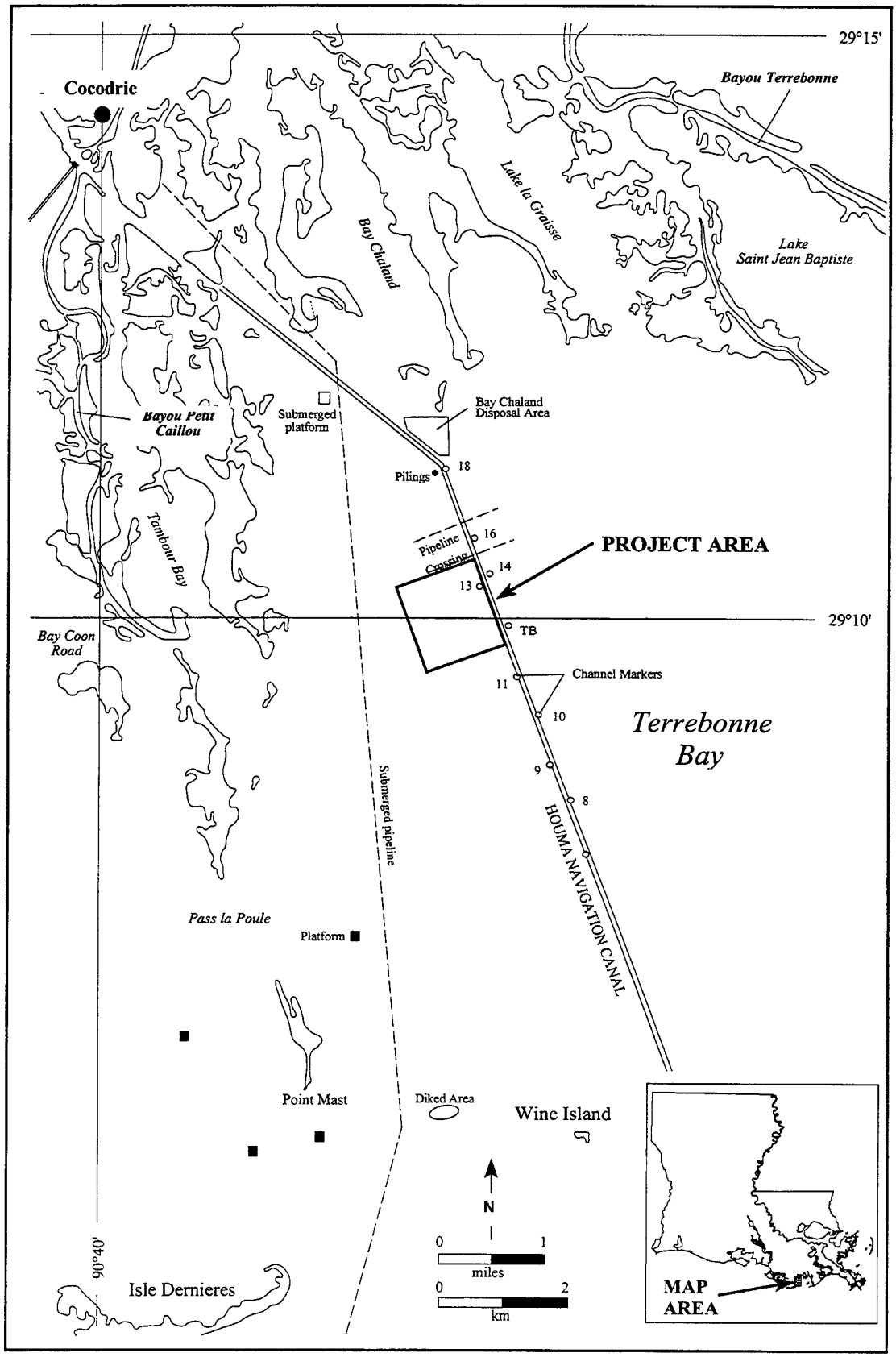

Figure 1-1. The project area.

to the northeast of the project area, and Bayou Petit (or Little) Caillou which enters into the western side of Terrebonne Bay just 2 mi west of the project area (see Figure 1-1). Vessels traveling into and out of these bayous may have passed near the project area. The closest community to the project area is the small town of Cocodrie, located on the natural levees of Bayou Petit Caillou where it is crossed by the Houma Navigation Canal.

Several shipwrecks are known to have occurred in this general area of Terrebonne Bay, and unreported wrecks likely exist. The remote-sensing survey reported here was conducted principally because of this potential for shipwrecks and boat wrecks in the area. The New Orleans District undertook the survey and investigations reported here in compliance with their responsibilities under various Federal rules and regulations; particularly 36 CFR 800, the rules governing Section 106 of the National Historic Preservation Act of 1966.

This study involved background historical research and a remote-sensing survey. The primary instruments used in the remote-sensing survey were the cesium magnetometer, side-scan sonar and fathometer. In the last two decades these instruments have become standard components in the array of equipment used in searching for shipwrecks. Later sections of this report provide details on this equipment and the conduct and results of the survey. It is important to recognize that these instruments, in general, can most easily detect larger historic craft such as steamboats, seagoing ships, large fishing boats, etc., particularly those containing large quantities of ferrous metal. Smaller boats or other cultural materials without iron elements, may exist as wrecks or resources in the study area; however, they are much more difficult to locate and identify.

The remote-sensing survey did record a number of magnetic anomalies and a few side-scan sonar features in the project area. However, none of these targets exhibit characteristics of known historic wrecks or other significant cultural properties and all are identified as discrete pieces of modern debris and trash, dumped or lost overboard from the many commercial and recreational boats and barges that have traveled the Houma Navigation Canal and the shallow waters of the project area. Detailed discussions on the conduct and findings of the survey are provided in later sections of this report.

In conjunction with the remote-sensing survey, data on the cultural and geological history and shipwreck potential of the project area were collected. This information provided a background against which the results of the remote-sensing data could be interpreted. Interpretation relied on the information available on watercraft use of the area, on vessel losses in the area and on past impacts that natural and man-induced activities may have had on wrecks in the area. Identification and evaluation of these impacts were derived, in part, from assumptions about various effects that these forces would have on a sunken vessel. Interpretation of remote-sensing data also drew upon the available literature on similar shipwreck surveys. Each of these factors is discussed in the following chapters.

The data developed in this study provide the New Orleans District with knowledge of the cultural resources potential of the project area. In addition, it is hoped that the information provided here will serve as a contribution to the broader area of the District's overall management of cultural resources. This study, also, provides a contribution to the expanding body of literature dealing with the application of remote-sensing survey in the search for shipwrecks.

Previous Archaeological Research

Several cultural resources studies have been undertaken in the general vicinity of the project area. Most of these involved examination of nearby land and marsh areas; relatively few studies designed specifically to locate underwater cultural materials have been conducted in

the region. Weinstein (1987) conducted a survey along Bayou Mauvais Bois in the Terrebonne Parish marshes west of the project area. This study involved investigations along two proposed pipelines and located several prehistoric shell middens. Heartfield, Price and Greene, Inc. (1989) conducted a survey for Tenneco Gas for a proposed pipeline near the juncture of Bush Canal and Bayou Terrebonne that revealed no cultural resources. Two cultural resources surveys (Castille 1983; Castille and Holmes 1983) were undertaken in the city of Houma to assess historic sites and standing structures along Bayou Terrebonne for a proposed bridge corridor. These studies were located well north of the present project area.

Only a few cultural resources studies specifically related to shipwrecks have been conducted in the vicinity of the project area. No surveys within the project area itself are recorded at the Louisiana Division of Archaeology and no sites are listed in the bounds of the project area. A cultural resources investigation of a portion of Bayou Grand Caillou, located about 10 mi to the northwest of the project area, by Flayharty and Muller (1983) located 69 derelict vessels along the bayou. A magnetometer was used in the survey, but no significant anomalies were recorded. Flayharty and Muller noted that local informants knew of submerged watercraft; and that the negative remote sensing results were probably due to the fact that most, if not all of these craft, were of mostly wooden construction. Two recent investigations have dealt with watercraft documentation in the region (Stout 1992; Robinson and Seidel 1995). While these studies were not in the project area, the variety of vessels documented represent the types that traveled on the streams and bays of lower Terrebonne Parish, including Terrebonne Bay.

In 1996, R. Christopher Goodwin & Associates conducted a remote-sensing survey of an Ocean Dredged Material Disposal Site along the east side of the Atchafalaya River Bar Channel, located just offshore of Atchafalaya Bay to the west of the present project area (Seidel et al. 1998). That study recorded a number of magnetic anomalies and side-scan sonar targets, several of which were considered to have a "moderate to high" potential of being significant cultural resources (Seidel et al. 1998:80). However, none of the anomalies were physically examined and Seidel et al. argued that these targets were likely to be buried too deep to be impacted by the activities associated with the proposed undertaking and recommended that no further archaeological investigations were warranted.

In 1998, Coastal Environments, Inc., conducted a remote-sensing survey and diver investigation of several targets of the portion of the Houma Navigation Canal extending though Cat Island Pass (Birchett and Pearson 1998). This survey located a number of magnetic targets, four of which were selected for diver identification and evaluation. None of the targets examined represented significant cultural remains; all were identified as, or thought to be, modern debris or objects (i.e., cable, pipe, etc.) related to oil and gas or commercial vessel activities. Although the Cat Island Pass study located no significant cultural properties, the results of the study, as well as the background historical and geological information it provides, are particularly relevant to the present study.

One study specifically related to shipwrecks in the region is the investigation of the remains of the eighteenth century Spanish merchantman *El Nuevo Constante* located west of the project area in offshore Cameron Parish (Pearson and Hoffman 1995). One primary importance of this work is its demonstration that significant archaeological remains can be preserved in shallow offshore conditions.

Several studies that are very broad in nature and consider much or all of entire Gulf of Mexico do have some relevance to the project area. Garrison et al. (1989) studied the outer continental shelf and Louisiana's coastal waters in *Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico*. Berman (1973) has compiled an extensive list of shipwrecks for the coastal waters of the United States. The Work Projects Administration

provided two studies that compiled data on vessels sailing in the region: *Ship Registers and Enrollments of New Orleans, Louisiana*, from 1804 to 1870 (Work Projects Administration [hereafter cited WPA] 1942) and the *Record of Casualties to Persons and Vessels On the Mississippi River, Its Tributaries, on Lakes and other Waterways* (WPA 1938). The project area is included in a broad discussion of the prehistoric and archaeological potentials of the Gulf of Mexico by Coastal Environments, Inc. (1977), although no specific information on the Terrebonne Bay area is given. Also, the region is considered by Pearson et al. (1989) in a general study of the history of waterborne commerce and shipwreck potentials within the New Orleans District. The project area was not considered specifically in this study and the navigation history of the immediate area was only minimally discussed. That study did note the wreck potential of the area was low until the construction of the Houma Navigation Canal in the early 1960s. The shipwreck potential of the navigation channel is given as "moderate" (Pearson et al. 1989).

No other cultural resources studies have been conducted in the immediate vicinity of the project area, although large number of remote-sensing surveys have been undertaken offshore in the coastal waters of Louisiana in relation to activities associated with oil and gas exploration and production. Gagliano (1978) reported on a survey in the West Cameron Area, which is outside the project area, but used essentially the same types of investigative methods to locate submerged cultural resources. In addition to the magnetometer, side-scan sonar and bathymetric instruments, a sub-bottom profiler was utilized to evaluate relict landforms to identify possible drowned terrestrial sites. One potential site, a suspected buried archaeological deposit, was located, but no shipwrecks were identified during the survey. Several magnetic anomalies were recorded, but they were associated with pipelines and offshore platforms. Another remote-sensing survey to the east of East Timbalier Island involved the evaluation of cultural resources for an offshore oil port marine facility (Gagliano, Small and Floyd 1978). This survey used the same array of instruments as the previously mentioned study, with the addition of divers, who examined several magnetic anomalies and took core samples along the pipeline right-of-way. None of the recorded magnetic anomalies were considered historically significant due to the fact that the "seafloor in the survey area is criss-crossed by pipelines and littered with debris related to the offshore mineral extraction industry" (Gagliano, Small and Floyd 1978). It was further noted in the report that operations associated with the mineral extraction industry tended to leave materials scattered around activity areas. It was determined that, typically, a field of discarded and lost trash and debris extended for about 2000 ft around drilling vessels or platforms. Along pipelines and communication cables, debris was found scattered over an area typically 1000 to 1500 ft wide.

In 1984, Floyd and Stuckey reported on a remote-sensing survey conducted to determine the location of seafloor or subbottom hazards to construction of a 10-in pipeline for Texas Gas Transmission Corporation. The instruments used in this survey were a magnetometer, side-scan sonar and a subbottom profiler. The pipeline route was in Blocks 2 and 9, south of Isles Dernieres and west of Cat Island Pass. Eleven magnetic anomalies were located; but all ranged from 15 to 24 gammas with very brief signature widths, suggested the anomalies "represented debris discarded during prior construction activities in this rather congested production field" (Floyd and Stuckey 1984).

CHAPTER 2

NATURAL AND CULTURAL SETTING

Natural Setting of the Project Area

The project area is located in Terrebonne Bay near the Louisiana coast in the physiographic region known as Mississippi River delta plain. The delta plain includes the lower portion of the present river, its present delta and areas occupied by former deltaic systems of the river. This is an area characterized by both fluvial and deltaic features, such as natural levees; abandoned and relict distributaries; interdistributary basins; vast areas of saline, brackish and fresh marshes; large saline and brackish bays; and coastal lakes, beach ridges and barrier islands. All of this area is low and flat with land surfaces rarely rising more than a few meters above sea level. The project area, specifically, is situated in Terrebonne Bay, one of a number of shallow water, brackish bays in the deltaic plain. Terrebonne Bay is a segment of a larger brackish water bay system that also includes Timbalier Bay, Lake Pelto, Lake Barre, Lake Felicity and Lake Raccourci. This bay system is bounded on the east by vast saline and brackish marshes associated with Bayou Lafourche, a relict Mississippi River distributary, on the north and west by similar marshes through which flow a number of streams that represent relict deltaic distributary channels and on the south by several barrier islands. These islands include East Timbalier Island, Timbalier Island, Wine Island, and a series of islands collectively known as Isles Dernieres (Last Islands). Several passes extend through the barrier islands, connecting the bays with the Gulf of Mexico. These include Little Pass Timbalier, Cat Island Pass, Wine Island Pass and Whiskey Pass. Today, the most important of these is Cat Island Pass, extending between Timbalier and Wine Island, because it contains the Houma Navigation Canal. Wine Island is almost completely gone, exposed primarily during periods of low water, but in the past it was larger and was part of the Isles Dernieres.

Terrebonne Bay is the westernmost bay in this system and is bounded on the west and north by marshes and relict landforms associated with Bayou Petit Caillou and Bayou Terrebonne, respectively. To the west is Timbalier Bay and to the south is Timbalier Island, Wine Island and Isle Dernieres. The two primary streams that empty into Terrebonne Bay are Bayou Petit Caillou and Bayou Terrebonne (see Figure 1-1). Geologically, these bayous represent relict distributary channels of an early Mississippi River deltaic system known as the Lafourche-Terrebonne system. Historically, these bayous connected the inland port city of Houma as well as other smaller communities, plantations and farms in Terrebonne Parish with the Gulf of Mexico through Cat Island Pass. While these bayous continue to be used by recreational and some commercial traffic (primarily shrimp and fishing boats), much of the commercial traffic now travels along several navigation canals constructed in this century. One of the most important of these canals is the Houma Navigation Canal which forms the eastern boundary of the present project area.

Geological Setting and History of the Project Area

The Mississippi River delta plain is a massive wedge of alluvial and deltaic sediments extending for almost 200 mi (320 km) along the coast of Louisiana and over 60 mi (100 km) inland. Its geologic history is related to a sequence of episodes of delta building and deterioration resulting from the progradation and subsequent abandonment of the present and former Mississippi River courses and deltas over the past 9,000 years or so. Thus, the Mississippi delta plain is a composite geomorphic feature consisting of numerous coalesced and stacked delta complexes which themselves are composed of numerous smaller units, commonly referred to as delta lobes. The surface morphology of each delta plain and lobe is similar, consisting of a network of distributaries that radiate out from an abandoned or active trunk channel and are separated by interdistributary troughs consisting of vast areas of marsh, swamp, ponds and lakes.

The geological history and sequences of delta development are reasonably well known for the Terrebonne Bay region. Between 8,000 and 12,000 years B.P. (before present), when sea level was as much as 200 ft (60 m) below its present level, the Mississippi River trended roughly along the present course of Bayou Teche. An entrenched valley associated with this early course runs through Atchafalaya Bay, 40 mi (65 km) to the west of the project area (Autin et al. 1991; Seidel et al. 1998). The valley floor of this Late Wisconsinan stream is approximately 150 ft (45 m) below present sea level and the valley itself is largely filled with Late Pleistocene and early Holocene sedimentary sequences. Between about 9,000 years ago and the present, as sea level began to rise, the Mississippi River built several delta complexes, each consisting of several delta lobes and numerous subdelta lobes. The delta complexes represent major shifts in the course of the Mississippi River. Drawing from Frazier's (1967) earlier work, and relying on recent archaeological data, Weinstein and Gagliano (1985:Fig. 1) have identified the following major delta complexes from oldest to youngest: Maringouin, Teche, Metairie, LaLoutre (St. Bernard), Lafourche-Terrebonne, Plaquemines and Belize, the modern delta complex (Figure 2-1).

Three of these delta complexes prograded into the area of Terrebonne Bay; the Maringouin, Teche and Lafourche-Terrebonne. The Maringouin delta complex developed in the area between about 7,300 and 6,200 years B.P when the Mississippi River occupied the western part of its present lower valley, generally following the course of modern Bayou Teche. This delta complex has no surface expression, having been eroded or buried beneath younger deltaic deposits (Autin et al. 1991:564). The Teche delta complex began to develop by 6,000 years ago, during a period of slowly rising sea level when the Mississippi River occupied the present course of Bayou Teche. Deltaic features of the Teche system prograded into the present lower Bayou Teche/Atchafalaya Bay area, covering older Maringouin delta features. Both Maringouin and Teche deltaic deposits have filled and covered the earlier entrenched valley of the late Pleistocene/early Holocene Mississippi River extending under Atchafalaya Bay (Seidel et al. 1998:6). The extent and thickness of Teche delta complex sediments in the immediate project area are not well defined, but to the west, in the vicinity of Atchafalaya Bay, these deposits are tens of meters thick. Offshore, the upper section of these Teche deposits have been removed by erosion, leaving behind a "ravinement surface" that has been identified in Atchafalaya Bay (Seidel et al. 1998:6). Penland and Suter (1983:372), using core and seismic data, identify a ravinement surface about 30 to 32 ft (9 to 10 m) below sea level beneath Isle Dernieres (Figure 2-2). This may be the eroded surface of Teche delta complex features. Weinstein and Kelley (1992:346) identified Poverty Point period materials from two buried prehistoric archaeological sites in the marshes of Terrebonne Parish northwest of Terrebonne Bay which they believe are associated with subsided landforms of the Teche delta system. These archaeological materials date circa 1,000 to 500 B.C. and were discovered a depth of 7 to 8 ft (2 to 2.5 m) below the present ground surface. The archaeological sites lie about 25 mi (40 km) north of the ravinement surface beneath Isle Dernieres and the differences

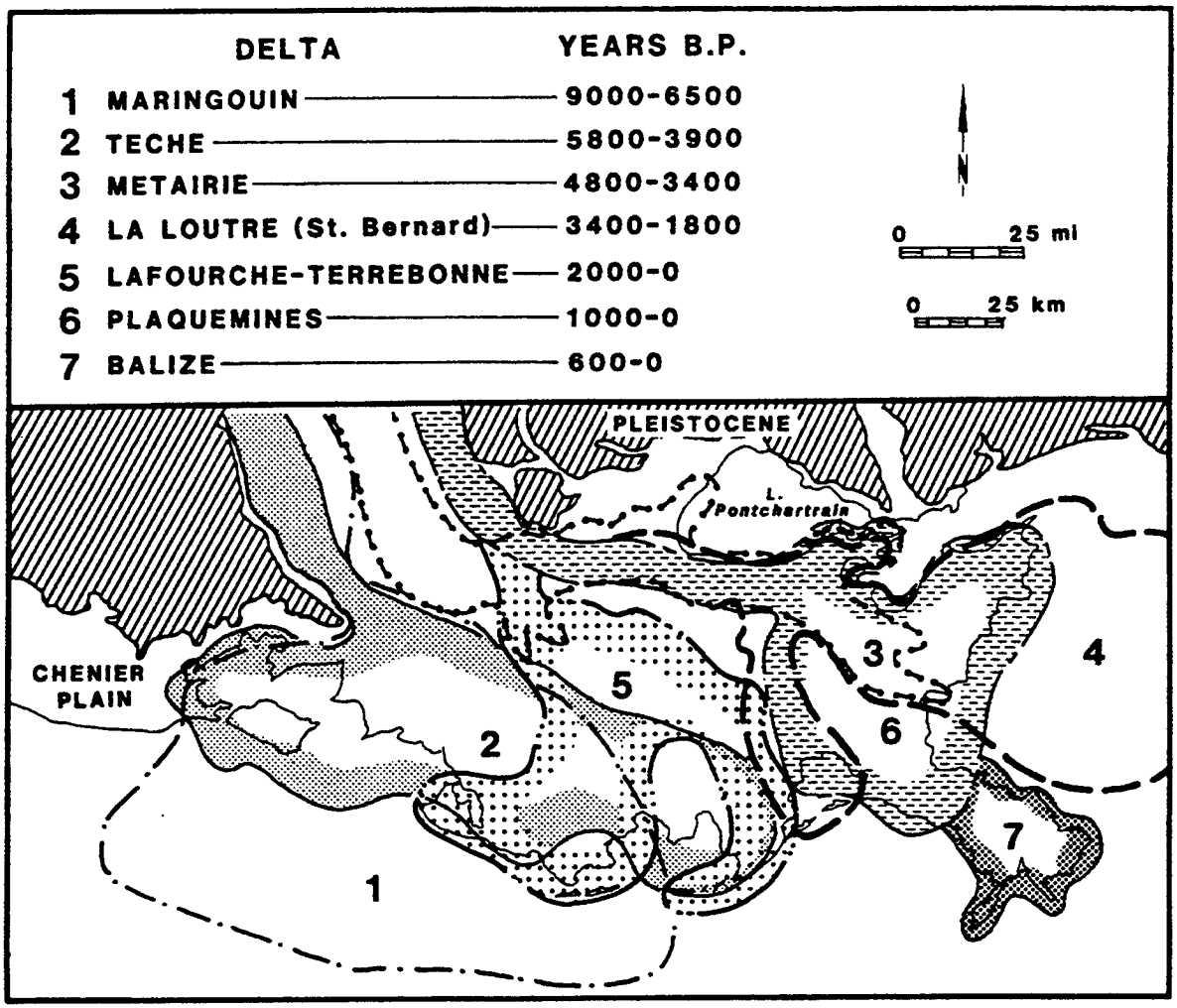

Figure 2-1. Mississippi River deltaic complexes (Weinstein and Gagliano 1985:Fig. 1).

in elevation between these two identified Teche surfaces is probably related to several factors, including the original differences in elevations of these two parts of the delta system; differential rates of subsidence, and, probably most importantly, the fact that marine erosion has removed the upper portion of the Teche surface in the vicinity of Isle Dernieres.

In the vicinity of Isle Derniers, delta front and distributary deposits that are associated with the abandoned Lafourche-Terrebonne delta complex lie above this ravinement surface (see Figure 2-2). The most recent geological evidence indicates that Lafourche-Terrebonne delta complex began as a distributary (present day Bayou Lafourche) off the main trunk of the Mississippi River approximately 1500 years ago (Tornqvist et al. 1996). This date is later than that proposed by earlier geological studies, but is in line with currently available archaeological data from the Lafourche-Terrebonne region (Pearson and Davis 1995; Weinstein and Kelley 1992). Possibly after only 500 years or so of progradation, flow into the Lafourche-Terrebonne system from the main trunk of the Mississippi River began to decrease and, soon, the system began to deteriorate. Bayous Petit Caillou and Terrebonne, which empty into Terrebonne Bay west and north of the project area, constitute two now-relict channels that were major distributaries of the Lafourche-Terrebonne system. At its greatest extent, approximately

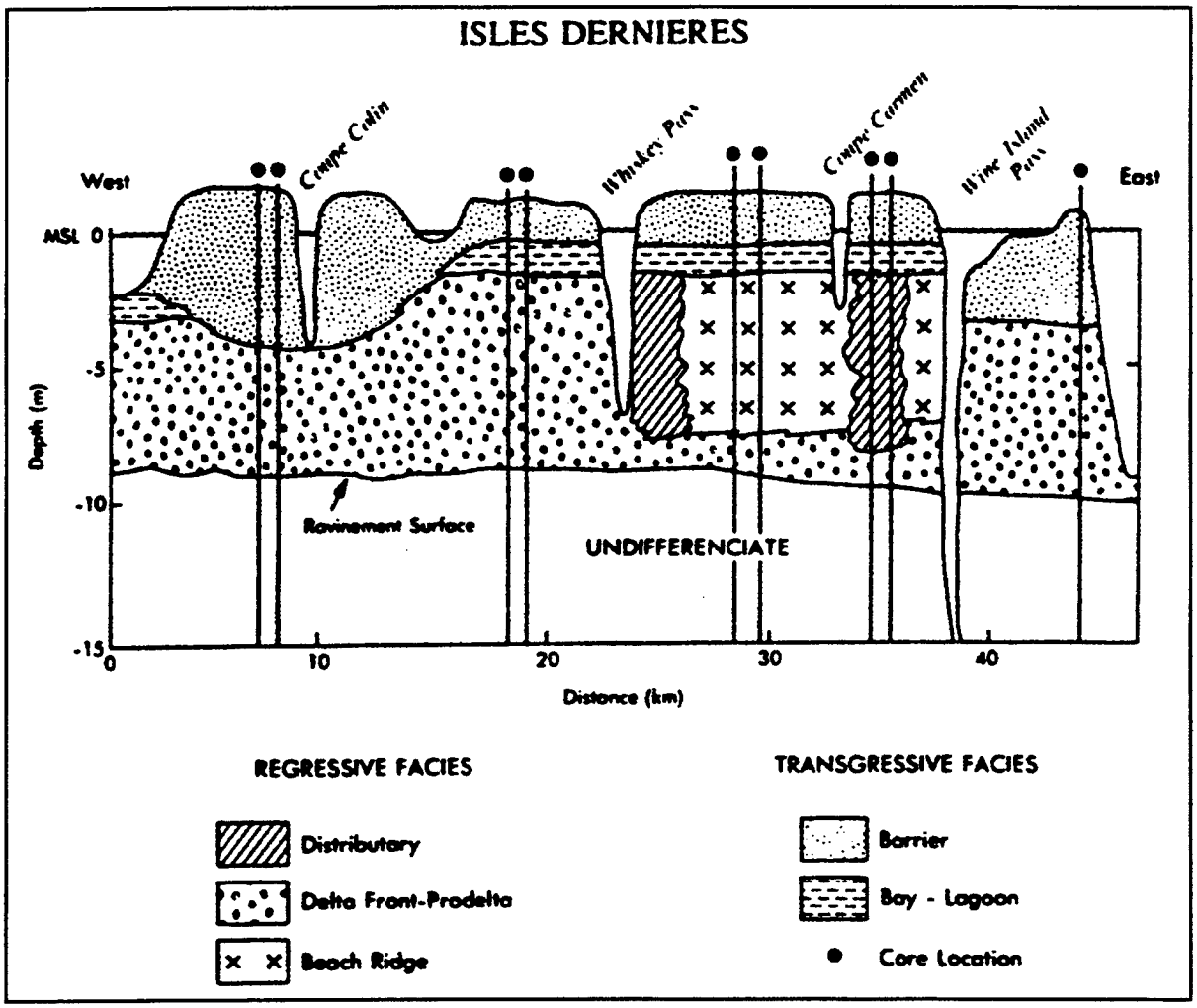

Figure 2-2. Stratigraphic section beneath Isles Dernieres (Penland and Suter 1983: Figure 7).

1000 years ago, these two bayous, other distributary channels and associated deltaic landforms would have extended some distance south of the present shoreline. At that time, the project area would have been some distance inland of the Gulf and its setting would have been typical of distributary systems; i.e., either natural levee or interdistributary environments and landforms. In Lake Pelto, immediately southwest of the project area, the tops of now buried channels associated with the Lafourche-Terrebonne system have been identified in seismic records at depths of only 2 to 3 m below sea level (Figure 2-3) (Penland and Suter 1983:372). There seems to be no doubt that these buried channels represent extensions of the relict distributary bayous still extant in the marshlands north of Lake Pelto and just west of Bayou Petit Caillou, such as Bayou Sale or Oak Bayou. Similar features associated with the Lafourche-Terrebonne delta complex presumably lie at very shallow depths beneath the project area.

Bay and lagoonal deposits constitute the bay floor sediments in the project area. These deposits, which in places are up to 2 m thick, represent eroded and reworked distributary sediments associated with Lafourche-Terrebonne delta features.

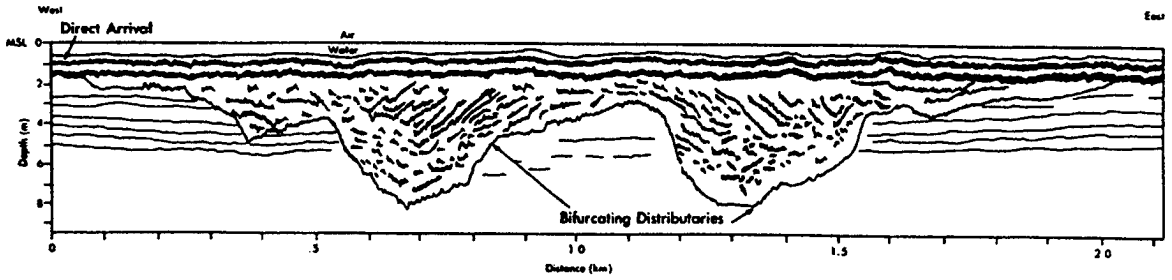

Figure 2-3. Drawing of high-resolution seismic profile showing buried distributary channels beneath Lake Pelto (Penland and Suter 1983:Figure 8)

The barrier islands located south of the project area were formed as the margins of the Lafourche-Terrebonne delta began to erode back once flow into the distributary system ceased about 1000 years ago. The Timbalier Islands were created over only the last 300 years as erosion from the Caminada-Moreau Headland at the mouth of Bayou Lafourche supplied sand for barrier development. Landforms developed into continuous duned terraces and spits on the downdrift ends of the islands. The Timbalier Islands are, therefore, "laterally-migrating, flanking barrier islands built by recurved spit processes" (Williams et al. 1992:4). The IslesDernieres are older and were formed by the erosion of the Bayou Petit Caillou headland and beach ridges over the last 600 to 800 years (Williams et al. 1992:4).

Recent Landform Changes in the Project Area

Today, the project area consists entirely of open water, but in the relatively recent past some or all of the project area contained marsh and/or natural levee landforms associated with the Lafourche-Terrebonne delta complex. As noted above, at one time landforms associated with this delta complex extended well south of the project area. Exactly how far this deltaic system extended south is currently unknown, but it was well beyond the present barrier islands. With the abandonment of the system by water flow from the Mississippi River about 1000 years ago, natural levee formation ended, progradation stopped and subsidence and erosion began to remove landforms associated with this now-relict system. The loss of land corresponded with the expansion of the shallow water bays in the area, such as Terrebonne Bay and Lake Pelto. A lack of data makes the very early history of land loss and landform change in the project area difficult to assess, but information on the more recent history of these changes can be gleaned from cartographic sources and from historic accounts. This assessment of landform changes in the project area is of importance in helping to establish the potential the area had for supporting vessel traffic over time as well as its potential for containing the remains of lost vessels.

A number of nineteenth century maps are available that portray landforms in the vicinity of the project area. However, few of these maps are very detailed in their presentation of landforms in the immediate vicinity of the project area. The earliest township plat maps of the area, based on surveys conducted in 1831, 1832 and 1839, provide almost no information on the project area itself, but they do contain information on the nature of other land surfaces in the vicinity during that time period. For example, surveys along Bayou Petit Caillou (Townships 21 and 22 South, Range 18 E) show that sections were mapped and platted along both sides of the bayou all the way down to what is now known as Pass la Poule, within a half mile or so of present-day Point Mast (Louisiana State Land Office [hereinafter cited LSLO] 1832, 1842). This suggests that there were exposed and elevated natural levees or relatively high marsh

extant along this entire lower stretch of the bayou. However, these original plat maps do indicate that elevated land adjacent to the bayou must have narrowed considerably about 4 mi south of the community of Cocodrie, corresponding roughly to the southern boundary of Township 21 South, because few "long lot" sections (i.e., sections that are long and narrow with the long axis extending from the bank of the bayou across the width of the natural levee toward or into the backswamp or marsh) are mapped in Township 22.[1] Today, most of the area contained in the land sections along Bayou Petit Caillou below the community of Cocodrie consists of open water, most of the high ground that once existed here having been lost to processes of subsidence and erosion.

Similarly, the early plat maps for the lower end of Bayou Terrebonne show long lot sections extending well out into Terrebonne Bay, well beyond Pass Barre, an area which today is entirely open water (LSLO 1832). As on Petit Caillou, the presence of these long lots suggests that areas of elevated land existed there in the 1830s when the survey of lower Bayou Terrebonne was conducted. Today, as along lower Bayou Petit Caillou, most of this elevated land has subsided and eroded away, leaving open water and some small areas of marsh.

Several other nineteenth century maps of the area were examined and all show that marsh and natural levee landforms were considerably more extensive in the area than they are today. For example, an 1853 coastal chart shows marshland extending almost all of the way to Isle Dernieres with Lake Pelto existing as a very narrow water body separating the island from the mainland (Penland and Suter 1983:372). Although not as detailed, other mid-nineteenth century maps show that distributary landforms (i.e., natural levee and marsh) of both Bayou Terrebonne and Bayou Petit Caillou extended much farther south than they do today. Colton's (1860) and Gray's (1879) maps of Louisiana both show these two bayous stretching most all of the way across present-day Terrebonne Bay. One hundred fifty years ago, landforms associated with Bayou Terrebonne extended almost all of the way to Caillou Island, located just north of Timbalier Island, such that they almost completely separated Terrebonne Bay from Timbalier Bay. Similarly, landforms associated with Bayou Petit Caillou stretched almost all of the way to the eastern tip of Isle Dernieres.

Several written accounts support the information shown on these maps. For example, an 1880 Corps of Engineers survey report examining Bayou Terrebonne noted that the mouth of the bayou had previously been at Caillou Island (located just north of the western end Timbalier Island), as is shown on Colton's and Gray's maps. It was reported that in 1850 Bayou Terrebonne ran between narrow strips of sea marsh between Timbalier Bay and Terrebonne Bay and that trips from Montegut all the way to Caillou Island by land were common (Chief of Engineers [hereinafter cited CE] 1880:1180; Guidry 1985:37). However, by the time of the survey in 1880, this area of marsh had broken up into isolated grass islands by the action of waves (CE 1880:1180). These processes of subsidence and erosion have continued and more fast lands are being eroded and water bodies, such as Terrebonne Bay and Lake Pelto, continue to expand.

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[1] An examination of section lines shown on the 1935 and 1983 USGS quadrangle maps shows that those located below Cocodrie are obviously incorrectly plotted. The original plat maps, made in the 1830s, definitively show that the long lot sections in the lower portion of Township 21 South and the northern portion of Township 22 South, Range 18 East are located on either side of Bayou Petit Caillou. However, on all modern quadrangles examined all of these sections are shifted a mile or so to the east. The original surveyors certainly followed Bayou Petit Caillou below Cocodrie, but it appears they either provided incorrect coordinates for the western line of the two townships (Range 18E), or later map makers have made the mistake.

The Point Meshe Distributary

Accurate information on landform change in the project area can be obtained only from fairly recent maps. Figure 2-4 presents specific information on landform change in the vicinity of the project area derived from three map sources. These are the most recent 1:100,000 map of the area dated 1983 (U.S. Geological Survey [hereinafter cited USGS] 1983), the 1908 Caillou Bay and Ship Shoal topographic quadrangle (USGS 1908) and the digitized map of the project area provided by the NOCOE that is derived from recent aerial photographs (NOCOE 2000). These maps clearly reveal the land loss occurring in the area over this approximately 90-year time span. Data from other twentieth century maps examined, such as the 1935 topographic quadrangle, are not included in Figure 2-4, but they were examined and they substantiate this trend in land loss.

As seen in Figure 2-4, in 1909 the marsh and natural levee landforms associated with Bayou Petit Caillou extended as a continuous feature to within a short distance of the eastern end of the pass between Wine Island and Isle Dernieres, known as Wine Island Pass. The southern tip of this projection of land was known as "Pt. Mast," a name which may very well derive from the presence of a wreck. By 1983, much of the lower several miles of this distributary had disappeared, plus extensive areas of marsh had been lost farther north along Bayou Petit Caillou. Also, during this period almost all of Wine Island had been eroded away.

In 1909, the eastern portion of the project area was occupied by landforms associated with the small, unnamed distributary that trended roughly north-south along the western edge of Bay Chaland (Figure 2-4). The extremity of this distributary was named "Pt Meshe." The course of this small distributary, which is here designated the Point Meshe Distributary, has not been totally delineated, but it appears to have originated either off the east side of Bayou Petit Caillou a mile or so north of the town of Cocodrie, or it is a branch of Bayou de l'Ouest which is a distributary channel of Bayou Terrebonne. The Point Meshe Distributary is an element of the Lafourche-Terrebonne delta system and is believed to have formed approximately 1000 years B.P.

Point Meshe (or Pt. Meshe) is a name that has been in use for at least 90 years, although the origin of the name is unknown. It appears on the 1909 map noted above, on the 1935 topographic quadrangle for the area (USGS 1935), as well as on the June 1998 Coast Survey nautical chart (NOAA 1998). In fact, on the 1935 quadrangle, a Geological Survey bench mark named "Point Meshe" is located at the point, falling within the boundary of the present project area. The 1998 Coast Survey nautical chart shows a small segment of land still extant at Point Meshe. However, it is obvious that the topographic information for the nautical chart is derived from earlier maps, because recent aerial photographs show that all of the land associated with Point Meshe had disappeared by 1998. In fact, the 1983 topographic map (USGS 1983) used to develop the shoreline in Figure 2-4, also, shows a small piece of marsh within the project area. This portion of marsh, as well as other small segments of marsh formerly located between the project area and the Bay Chaland Disposal Area to the north, have disappeared since 1983, as is shown in Figure 2-4.

Although the map evidence is not entirely clear, it does appear that the landforms of the small distributary which formed Point Meshe have not extended much south of the position shown on post-1909 maps since the mid- to late-nineteenth century. This distributary is not even portrayed on the 1830s plat maps of the area, suggesting it contained no significant elevated land worthy of survey. Further, even though they lack detail, none of the mid- and late-nineteenth century maps examined show any extensive landform projecting very far south into Terrebonne Bay between Bayous Petit Caillou and Terrebonne in the vicinity of Point Meshe. Finally, the designation of this landform as a "point" as early as 1909 suggests it was

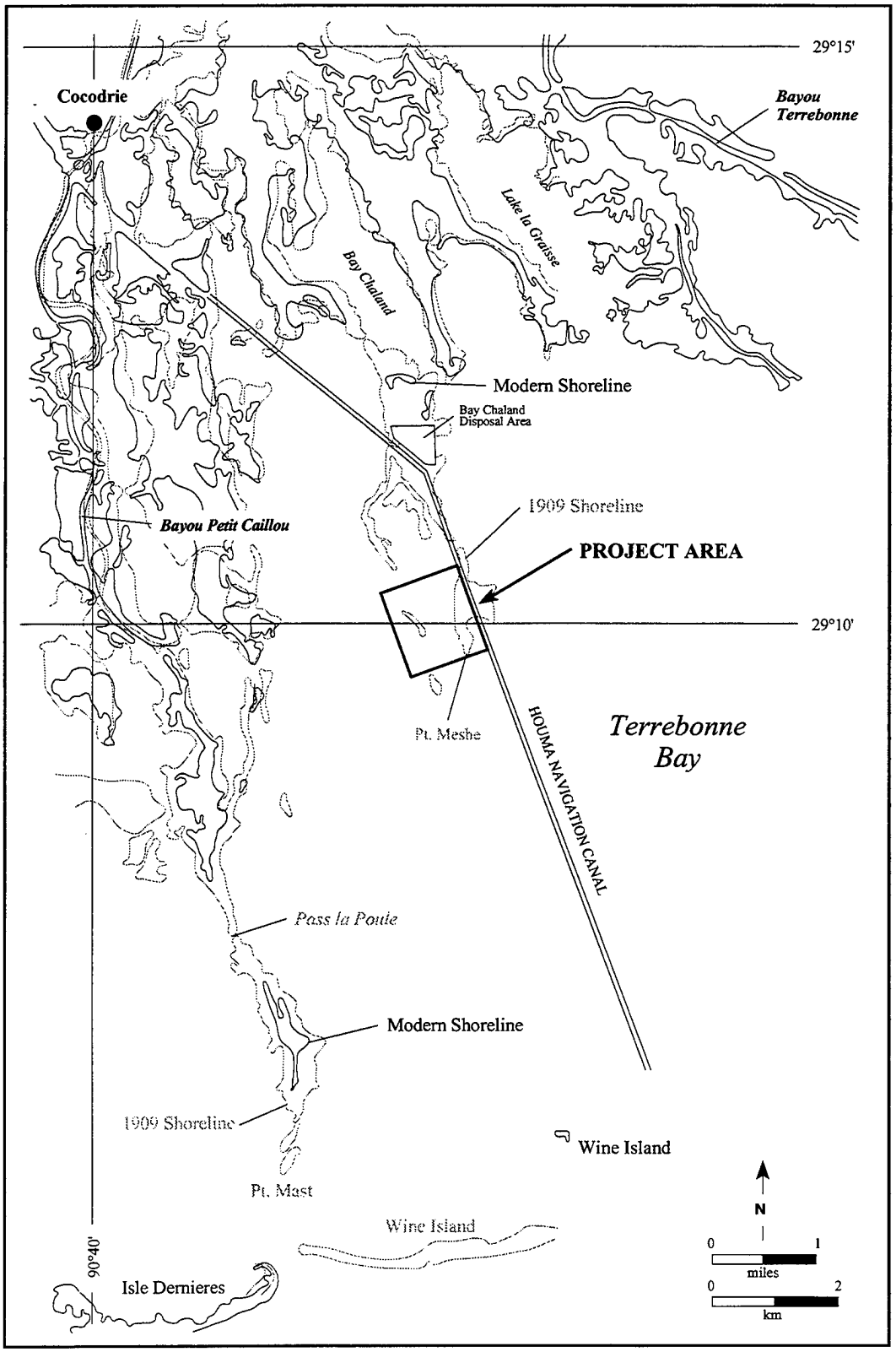

Figure 2-4. Landform changes in the project area, 1909-present. 1909 shoreline (gray) from USGS 1909; modern shoreline (black) from NOCOE 2000 and USGS 1983.

recognized as a terminal projection of land at least by that date, and very possibly for some period of time prior to that.

This assessment of landform changes in the project area has direct implications for the study of shipwrecks. Most importantly is the fact that part of the project area was exposed land (albeit low marsh) until fairly recently and these land areas could not have been traveled by watercraft. Also, maps indicate that areas of exposed natural levee and marsh associated with the Point Meshe distributary existed to the north and northeast of the project area until relatively recently. These, also, would have precluded boat travel until they began to break up in the early years of this century. No evidence of the actual stream channel of the Point Meshe Distributary can be seen on any of the maps examined, suggesting it had been filled prior to 1909. This means that no channel suitable for boat travel has existed along the Point Meshe Distributary for, at least, the past 100 years or so. No historic accounts have been found that mention Point Meshe in relationship to boats or boat travel and it is likely that the distributary channel had filled well prior to 1909, perhaps even before the arrival of Europeans settlers in the area in the mid-eighteenth century. Further, there is no evidence that the land in the project area has ever been suitable for habitation during the recent past, effectively eliminating the possibility of the existence of any permanent boat landings or docking facilities there. All of these factors would have eliminated or, at least, lessened boat travel, docking, or anchoring in and near the study area, thus decreasing the probability of wrecks or abandonments occurring there. More complete discussions on the shipwreck potential of the project area, and Point Meshe, are provided later.

Although the Point Meshe Distributary system is not believed to have been amenable to watercraft use or settlement during the historic period, it almost certainly would have been suitable to travel by the dugout canoes of prehistoric populations at some time in the past. Additionally, it is likely that prehistoric populations used and, very possibly, occupied the natural levees of the Point Meshe Distributary. No prehistoric sites are reported from landforms that can be associated with this distributary, but, numerous prehistoric shell midden and earth mound sites have been found on other relict distributaries in the region. Along most of its length, the natural levees of the Point Meshe distributary have subsided or been eroded away. Any prehistoric sites that might have existed on these levees, including those extending through the project area, will have been destroyed by erosion or are now buried beneath the marsh north of Terrebonne Bay or are both buried and submerged beneath the waters of the bay.

Cultural History of the Project Area

This chapter presents an overview of the culture history of the region around the project area with an emphasis on its navigation history. Much of the information presented here is derived from the earlier cultural resources study of Cat Island Pass by Coastal Environments, Inc. (Birchett and Pearson 1998). Additionally, this historical overview considers the guidance provided by two cultural resources management plans developed by the state of Louisiana. One of these, related specifically to underwater properties, is the *Louisiana Submerged Cultural Resource Management Plan* (Terrell 1991) and the other is entitled *Louisiana's Comprehensive Archeological Plan* (Smith et al. 1983). The underwater plan provides a synthesis of the history of navigation and of underwater archaeology in the state, plus it identifies and prioritizes research objectives and preservation goals seen as important in the treatment of underwater cultural remains. The *Comprehensive Archeological Plan* organizes the state's history into spatial and cultural units that provide a frame of reference for conducting archaeological research. The cultural units most relevant to this study fall into the period following the arrival of Europeans into the region and include: Historic Contact; Exploration and Colonization; Antebellum; War and Aftermath; and Industrialization and Modernization. The following discussions consider all of these chronological periods, although the discussions

are not explicitly organized around these individual topics. The prehistoric period, as is discussed below, is of less relevance such that all of the prehistoric cultural units provided in the state Plan are grouped into one section for discussion.

Prehistoric Period

Large numbers of prehistoric archaeological sites are known from the marshlands lying north and west of the project area. The age and distribution of these sites are reasonably well known, as are many of the factors behind their occurrence (Weinstein and Kelley 1992). The potential for prehistoric site occurrence in this region, including the project area, is closely related to geomorphology. At 12,000 years B.P., a generally accepted date for the arrival of humans into the region, sea level was as much as 197 ft (60 m) lower than at present. At that time, the project area and a considerable amount of the offshore continental shelf was subaerially exposed land surface, presumably used and occupied by early prehistoric populations. Rising sea level over the past 12,000 years has submerged early sites on the continental shelf, plus those located near the coast have become buried by sediments associated with the progradation of various Mississippi River delta systems into this region. In the vicinity of the project area, all prehistoric sites older than 1500 years or so will have been buried by sediments associated with the Lafourche-Terrebonne delta complex. Any sites of this age or older that may have existed in the project area and which have withstood the damaging impacts associated with rising sea level or with delta formation will now be submerged as well as buried beneath at least several meters of Lafourche-Terrebonne sediments. Finding these sites, or more appropriately, the high probability landforms on which these sites are located would require instruments such as a subbottom profiler or some type of drilling or coring machinery; neither of which were utilized in this study.

The majority of the prehistoric sites discovered in the Terrebonne Bay area are associated with landforms of the Lafourche-Terrebonne delta complex. For the most part, prehistoric sites were established on deltaic landforms that provided high and reasonably well-drained settings. Natural levees presented the most advantageous setting, but sites, also, are found on some other landforms, such as elevated beach ridges. Numerous prehistoric sites have been discovered along the natural levees of the two major bayous that enter into Terrebonne Bay near the project area, Bayou Terrebonne and Bayou Petit Caillou, as well as along smaller distributaries. These sites consist principally of shell middens, but a few earthen mounds are known. Over time, as these deltaic landforms have slowly subsided so have the prehistoric sites established on them. Today, many partially submerged prehistoric sites are known from the region, and many totally subsided sites are believed to exist.

As has been discussed previously, until fairly recently exposed landforms associated with what is here called the Point Meshe Distributary occupied part of the project area. The available evidence suggests that over the past century or so this distributary never extended much beyond the project area, ending at the landform known as "Pt Meshe." There seems no doubt that this small distributary was associated with the Lafourche-Terrebonne delta system, probably forming within the past 1,000 years or so. All traces of any subaerial landforms of the Point Meshe Distributary in and near the project area have been removed by erosion in the past two decades; however, there is reason to believe that buried elements of this distributary system may exist in the project area. For example, immediately southwest of the project area, in Lake Pelto, portions of now buried channels believed to be associated with the Lafourche-Terrebonne system have been identified in seismic records at depths of only 2 to 3 m below sea level (Penland and Suter 1983:372). It is possible, then, that portions of the natural levees and filled channel of the Point Meshe Distributary may exist as buried features in the project area.

Evidence from small distributaries on the east side of Bayou Lafourche, indicates that natural levees near the terminal ends of small distributaries like Point Meshe are on the order of

at least 3 or 4 m thick (Pearson et al. 1989). Although natural levee deposits begin to form at or near the ground surface, in coastal Louisiana they quickly begin to subside due to the soft, commonly highly organic underlying sediments. Subsidence rates are high in this region; Roberts et al. (1994) recording average subsidence rates of Holocene deposits in the area as high as 42.9 cm per 100 years. If similar rates hold for the project area, then approximately 4.2 m (14 ft) of subsidence might have occurred along the Point Meshe Distributary, assuming it was formed approximately 1,000 years ago. This amount of subsidence means that significant portions of the distributary's natural levees are now buried beneath the bay floor in the project area where water depths are about 8 ft (2.5 m). However, it is presumed that the upper sections of these natural levees have been removed by erosion. Prehistoric remains in the region tend to lie on or very near the surface of natural levees, that segment which is believed to have been removed from the levees of the Point Meshe Distributary. Thus, while there is a reasonable probability that natural levee landforms once extant in the project area were used or occupied by prehistoric populations and that these landforms now exist as buried and submerged features, erosion of the tops of now subsided natural levees will have removed or seriously disturbed evidence of this occupation.

Historic Period

The earliest European activity in the vicinity of the project area was associated with Spanish shipping in the Gulf of Mexico. The earliest commercial routes in the Gulf were related, principally, to the movement of New World goods back to Spain. From the second decade of the sixteenth century on, Spanish ships crossed the Gulf from Vera Cruz to Havana, normally taking advantage of currents that flow eastward just off the Gulf coast (Garrison et al. 1989; Pearson and Hoffman 1995). This may have brought Spanish vessels near the coast off Terrebonne Bay, but there is no direct historical evidence of any Spanish landing or exploration of the region during this early period.

European exploration of the Louisiana coast did not truly begin until the French began to explore and colonize the region in the late 1600s. In 1682, Rene Robert Cavelier, sieur de La Salle, led a small party of Frenchmen and Indian guides down the Mississippi River to its mouth. La Salle made no effort to examine the coast beyond the mouth of the river, but he did name the territory Louisiana, in honor of the king of France (Weddle 1987). In 1699, the Canadian Pierre Le Moyne, seigneur de Iberville, initiated French settlement along the Gulf coast with the establishment of a settlement near modern Biloxi. Soon, the French had settlements at Dauphin Island and Mobile and had begun to explore the region of the lower Mississippi River. Iberville's brother, Jean Baptiste le Moyne, sieur de Bienville, explored down Bayou Lafourche as early as 1699, but there is no evidence that the French visited the lower reaches of Bayous Terrebonne or Petit Caillou at this early date. In 1718, New Orleans was established and settlement expanded along the banks of the lower Mississippi. The earliest Europeans to visit the present-day lower Terrebonne Parish area were probably French trappers and, prior to 1765, few Europeans had settled there (Watkins 1937). Beginning in 1764, Acadian settlers began to move into the region, most of them coming down Bayou Lafourche and across to Bayou Terrebonne. This migration of Acadians continued until about 1795, under the encouragement of the Spanish who had acquired Louisiana from the French in 1763. These Acadian emigrants settled along the fertile natural levee lands along the many bayous in the area and, initially, established small farms. Soon, they spread to most of the habitable natural levee lands in the region and, in addition to farming, added stock raising, hunting, fishing and trapping. These early French settlers named the region Terrebonne, which means "the good earth," in recognition of the richness of the area.

Not long after the acquisition of Louisiana by the United States in 1803, Anglo-American settlers began to move into the Terrebonne area. Many of these individuals acquired large tracts of land and established cotton and, later, sugarcane plantations. As a result, many

of the original Acadian settlers removed to more isolated and, often, marginal areas and were forced to engage in other economies, such as fishing and trapping. Some of these Acadians settled along the lower reaches of Bayous Petit Caillou and Terrebonne, in the vicinity of the project area (Seidel et al. 1998:9).

In 1822 Terrebonne Parish was created from Lafourche Parish. Although the upper reaches of the parish was settled, most of the lower Terrebonne was still a wilderness. Michel Theriot established the first plantation on Bayou du Large in 1839. As late as 1841, when the Robichauxs settled near Montegut on Bayou Terrebonne, the region was described as "a complete wilderness...and nearly all kinds of wild animals abound, deer, bear, etc., Houma consisted at that time of three or four little houses" (Becnel 1989:12-13). The first actual buildings in Houma were erected in 1834 and until 1847 were confined to the south bank of Bayou Terrebonne. The corporate limits were expanded to include the north bank of the bayou in 1899 (Castille 1983:2). Although it was not the first town established in Terrebonne, Houma soon became the largest and has remained the principal urban center in the parish to this day.

It was during the 1830s and 1840s that sugar cane cultivation began to dominate the region and it remained the major industry until early in the twentieth century. By 1851, there were over 100 large sugar plantations with 80 sugarhouses in production in Terrebonne. There were twelve sugar plantations on the lower Terrebonne and in 1891 the great Terrebonne Sugar Mill opened at Montegut (Wurzlow 1985:VII:58). By 1905, with the introduction of oyster and shrimp canning/packing in the late 1800s, Houma became one of the largest oyster shipping ports in the world (Castille 1983:2). The oysters were processed; they would be unloaded from luggers by air suction and sent to the steamer by conveyer to be brined and cooked in the shell. They were then mechanically shucked (Wurzlow 1985:VIII:97). Houma's population grew steadily; but in the 1920s and 1930s, the city experienced rapid growth due to the discovery of oil and gas in Terrebonne Parish (Castille 1983:3).

Maritime Travel and Commerce in the Project Area

Travel by boat was, and still is, a way of life for those who live along the bays and bayous in lower Terrebonne Parish. Natural waterways are numerous and, until relatively recently, trails and roads were few and those that existed were muddy and impassable much of the time. During the historic period, it was normally only by boat that one could travel reasonably within the region and reach outlying communities and fishing spots, oyster beds and shrimping grounds. Even during the prehistoric period, travel by boat would have been common. The dugout canoe, or *pirogue* as it was called by the French, was the characteristic type of watercraft used by the area's native populations, and it was adopted by the later European settlers. Dugout canoes generally were constructed of a single cypress log and could measure over 30 ft long (Pearson et al. 1989). The preserved remains of several prehistoric and early historic period dugout canoes have been found in coastal Louisiana, although none are reported from the immediate vicinity of the project area. The numerous prehistoric shell middens along the relict stream channels of the Terrebonne region suggest canoes were extensively used, not only to reach settlements, but in the exploitation of shellfish, fish and other food resources. At some time in the past, dugout canoes may have been use to travel along the Point Meshe Distributary channel, which extended into, or passed through, the project area.

With the establishment and growth of European settlements in the Terrebonne area, the need for watercraft to move merchandise and people increased. A variety of small vessels came to be used in travel and commerce along the region's waterways. These included the local craft such as pirogues, chalands, esquifs and bateau which were small, flat bottomed and shallow drafted, and well adapted to the shallow, winding waterways of the region

(Knipmeyer 1956). Over time, larger craft, such as flatboats, luggers, sloops, steamboats and, perhaps, keelboats came into use (Birchett and Pearson 1998). These vessels were used to move people and to carry the commodities of the region to market, which normally meant travel to New Orleans or to an intermediate location such as Houma, Thibodaux or Donaldsonville where goods were transshipped. During the nineteenth century, goods moving out of the region included cotton, corn, indigo, molasses, rice, sugar, tafia and lumber (Gould 1951). Sugar, for example, was brought to New Orleans in "pirogues, skiffs, or boats made from solid logs. Each planter has his boat and,...could send his crop to market in it -- a few hogshead or bales at a time" (Gould 1951:211). Poor records related to this trade provide little insight into the receipts of Louisiana sugar, molasses and rice delivered in this manner. Sailing sloops, schooners and luggers, also, were involved in this type of trade. While much of the trade was along inland waterways, many vessels traveled along the coast in the Gulf of Mexico. These vessels would have had to utilize the passes leading into Terrebonne Bay and many would have traveled into and out of Bayous Terrebonne and Petit Caillou.

During the Civil War, the Union blockade of the Louisiana coast suppressed most commercial maritime activity. However, the coastal area was used by some blockade runners. Most of these blockade runners were small sailing vessels and little is known about them, but a few larger steamers also attempted to sneak in or out of the area's myriad of waterways. One of the sailing vessels which attempted to run the blockade into the Terrebonne Bay area was the 90-ft schooner *Major Barbour* (Official Records of the Union and Confederate Navies in the War of the Rebellion {hereinafter cited ORN] 1903:88; WPA 1942:5:165). In February 1862, the Union blockading vessel USS *DeSoto* captured the *Major Barbour* "inside of Isle Derniers" as the schooner was attempting to run the blockade from Havana. The *Major Barbour* was carrying a valuable cargo including gunpowder and percussion caps (ORN 1903:88). Considering its point of capture, inside of Isle Derniers, it appears as if the schooner was in the vicinity of Lake Pelto or western Terrebonne Bay, possibly attempting to enter one of the bayous there, such as Petit Caillou or Sale. In the same month, a Union report appeared stating that the blockade runner *Miramar* had come in at the "Grand Caillou," probably referring to Bayou Grand Caillou, a short distance west of the project area (ORN 1921:683).

Blockade running and smuggling remained active in the lower Terrebonne area during most of the war. In 1864, Union officer Captain Moore was sent to Bayou Grand Caillou to try to locate and break up a group of Confederate smugglers. Raids were planned and carried out capturing considerable amounts of food and equipment and a few small boats were destroyed. One boat was mentioned that was not captured, a small schooner that was being used as a blockade runner (Official Records of the Union and Confederate Armies in the War of the Rebellion 1893:927-929).

Confederate naval activity was minimal in the immediate vicinity of Terrebonne Bay and appears to have been confined to scouting and patrol duty. For example, in September 1861, the small Louisiana state "War Schooner" *Antonia* was ordered to the "Timbalier Islands" to assist two schooners "loaded with arms for the State or for the Confederacy" (Pearson 1993:472). It is not known where, or if, the *Antonia* found these vessels. Later, in November 1861, the *Antonia* was sent to Brush Island to remove or destroy any cattle that might be there to prevent Union forces from obtaining them. Brush Island is located in lower Timbalier Bay about 10 mi southeast of the project area. The *Antonia* spent some amount of time patrolling the coast attempting to aid blockade runners and searching for local citizens who might be communicating with the enemy blockade ships (Pearson 1993).

It was not until several years after the Civil War that waterborne commerce in the lower Terrebonne region revived. After the War, steamboats became increasingly important as carriers of goods and people. Steamboats had begun to travel the waters of the area in the third decade of the nineteenth century (Birchett and Pearson 1998). Bazet (1934:37) reports that the

S.F. Archer was one of the first steamers to operate exclusively in Terrebonne Parish. Built along the Ohio River at New Albany, Indiana, in 1854, the sidewheeler *Archer* was owned by J.J. Schaffer & Company and traveled along Bayou Black, making connections with the railroad at Tigerville (Way 1994:407). Other steamers operating in the region were the *Harry, Laura, Sadie Downman* and the *N. H. Breaux* to name just a few. The *Harry, Laura* and the *Sadie Downman* belonged to the Daigle Barge Line, whose founder was Emile A. Daigle. The *Harry* and the *Laura* were the first big steamers on Bayou Terrebonne in 1881. They carried only freight in the early days. They would haul barges loaded with lumber and sugar and produce to Houma to be shipped to New Orleans. They would carry groceries, dry goods and other supplies on the return trip. In the early steamboat days Daigle would dredge the bayou in Houma at his own expense to keep his boats running. He also had a wharf in town where he built barges and had a crew of painters and carpenters to maintain his boats. Emile Daigle had a large interest in the drayage business and owned several landings and wharfs along the bayou. He was a charter member of the Houma Fish and Oyster Company and had an interest in an oyster shop at Sea Breeze. The *Harry* and the *Laura* also towed long strings of barges loaded with "Beaumont" oil. "Sometimes you could see as many as eight or 10 barges trailing behind one of the big boats. The last barge had a long chain dragging an anchor to keep the tow from swinging. You could always tell where the anchor was by the stream of bubbles." The *N. H. Breaux* succeeded the *Laura* and was the last steamer on the bayou in 1930 (*Houma Daily Courier* Sept. 26, 1971).

In the late nineteenth century, railroads increasingly began to replace watercraft in the movement of commerce in the area. The speed and reliability of the railroad, relative to sail and steam vessels were major reasons why shippers were attracted to it. This speed was particularly important in shipping perishable goods, such as oysters. In the Terrebonne region, the oystering industry expanded significantly with the expansion of new rail lines into the area. Soon large numbers of small vessels, particularly sailing and, later, motorized luggers, took up oystering and fishing in the waters of Terrebonne and Timbalier bays. The railroad, plus other technological advances in processing oysters, made Houma one of the most important oyster shipping centers in the country in the early 1900s.

Some information on commercial traffic on the waterways of the lower Terrebonne region can be obtained from records published by the Corps of Engineers in the Annual Reports of the Chief of Engineers. However, these records are generally available only for the time period after about 1880. One of the area's waterways for which commercial traffic and navigation information is available is the 28-mi-long Bayou Petit Caillou. The bayou had been used since the earliest years of European settlement by a variety of small vessels carrying merchandise and produce into and out of Houma and surrounding communities, plantations and farms. The upper channel of Petit Caillou was reportedly filled and was no longer considered navigable by 1882. At that time, the water depth at the channel mouth was from 2 to 11 ft. During the late nineteenth century, several man-made canals, generally about 4 ft deep, connected Bayou Petit Caillou with other waterways (CE 1882:1413-1414). No information is provided on commerce for Petit Caillou until the 1930s, probably suggestive of the minimal amount of commercial traffic traveling along the bayou. Data for the year 1935 are shown in Tables 2-1 and 2-2. As can be seen, the vessels used were "motor" vessels and barges and much of the commerce reflected the oystering and shipping activities of the area.

Bayou Terrebonne, the other principal historic waterway near the project area, was more important than Petit Caillou as a commercial route. During the early nineteenth century, Houma served as the head of navigation on Bayou Terrebonne; by 1880 the channel above Houma was nothing more than a drainage ditch and was useless for navigation. Below Houma the channel was a shallow tidal bayou. Ultimately, Houma, because of its advantageous location at the head of navigation became the major port town in the region and numerous businesses and facilities for handling boat-borne merchandise were established. Sugar and

Table 2-1. Trips and Drafts of Vessels on Bayou Petit Caillou for 1935 (CE 1936:631).

	Up-bound				Down-bound			
Draft (feet)	Steamers	Motor Vessels	Barges	Total	Steamers	Motor Vessels	Barges	Total
6		14	1,203	1,217		14	1,193	1,207
5	200	714	123	1,037	200	714	113	1,027
4	52	353	352	757	52	364	342	758
3		1,429	242	1,671		1,429	232	1,661
2		166	264	430		133	313	446
Total	252	2,676	2,184	5,112	252	2,654	2,193	5,099
Total net registered tonnage	3,012	19,577	219,785	242,374	3,012	19,253	223,840	246,105

Section included: 36 miles. Controlling depth: 6 1/2 feet. Project depth: Navigation season: Entire year.

Table 2-2. Commerce on Bayou Petit Caillou for 1935 (CE 1936:627).

Domestic			
In-Bound		**Out-Bound**	
	Tons		**Tons**
Animals and animal products:		Animals and animal products:	
Oysters, unshucked	355	Oysters, canned	80
Shells	2,950	Shrimp, canned	200
Shrimp, dried	26	Shrimp, dried	50
Shrimp, fresh	295	Shrimp, bran	100
Shrimp, bran	70	Wood and paper:	
Nonmetallic minerals:		Cordwood	25
Gasoline	225	Logs, barged	457
Oil, fuel, and gas	1,200	Nonmetallic minerals: Gasoline	50
Oil, lubricating	15	Unclassified: Ice	1,100
Total	**5,136**	**Total**	**2,062**
Value, $54,0095		Value, $80,377	
		Total, all traffic	**7,198**
		Value, $134,472	

lumber were major commodities handled at Houma, but many other goods also passed through the town's docks. Castille and Holmes (1983:26) note the importance of the oyster packing industry in the town by the 1920s and report that commodities such as animal furs, cattle and alligator hides and frog legs were packed in barrels with layers of salt and shipped, primarily to New Orleans. Two steamers traveled the lower end of Bayou Terrebonne in 1880 "bringing freights from plantations on Terrebonne and other connecting bayous to Houma for shipment by rail" (CE 1880:1179-1180). The greatest part of the freight up the Terrebonne was from the sugar plantations, which included sugar and molasses. Navigation of the upper end of Terrebonne near Houma was done at high tide, which, depending on the winds in the bays, often gave an additional 2 ft of water. Prior to 1880, some commerce on the upper Terrebonne was handled "by flatboats which were cordelled and poled from plantations up to Houma" (CE 1880:1179-1180). There was a connection by rail at Houma with Morgan's Louisiana and Texas Railroad where freight was then shipped to market. Schooners and sloops also carried a considerable amount of freight through the bays and connecting bayous to New Orleans (CE 1880:1179-1180). Sometimes these vessels would sail out into the Gulf of Mexico, using one of the several available passes, among which were Wine Island Pass and Cat Island Pass, just south of the project area.

Information on the commercial statistics for Bayou Terrebonne for the year 1915 for registered vessels shows a total of 7 steamers and 12 gas boats operating on the bayou at that time (CE 1916:2449-2450). The steamers carried a total of 1,500 passengers. For unregistered vessels there were 375 gas boats and 150 unrigged barges. Unregistered vessels, generally, were those less than 20 tuns in burden. Many of these unregistered "gas boats" were probably involved in the oystering and fishing industries. The freight that was carried during the year consisted of a variety of articles. The item that had the greatest value was sugar, valued at $1,132,000. A large quantity of logs was shipped in that year; 15,604,300 feet or an equivalent of 62,417 short tons, reflecting the importance of the timbering industry in the early years of this century. Other commodities shipped in large amounts on Bayou Terrebonne were ground and grain feed, fertilizer, molasses, fuel oil, oysters, potatoes and miscellaneous merchandise. Smaller quantities of brick, cement, coal, cooperage, lime, lumber, machinery, naval stores, pilings and cypress ties were shipped, as well as, agricultural products such as, corn, eggs, furs, fish, hides, moss, oats, rice, salt, and shrimp (CE 1916:2449-2450). Between 1888 and 1935 freight tonnage on Bayou Terrebonne increased from 5,416 to 115,666 tons (Table 2-3). During roughly the same period steamship traffic increased from 15 to 252 trips and barges made from 9 to 2184 trips (Table 2-4).

These published commercial statistics provide information on the types of vessels and cargoes travelling along the area's waterways, but they do not convey information on the innumerable small craft that were in use. Large numbers of small vessels, many if not most locally made, were in use in the area from the very earliest periods until today. These included such local vessels as pirogues, bateaux, skiffs, sailing luggers and the like.

The great importance of watercraft in the region inevitably meant that boat building would become important. There were some commercial builders in the area, but many built boats primarily for personal use, family or friends. One of the commercial builders along Bayou Terrebonne was John A. Boyne and his sons John Madison, Andrew and Bill. They had two boatways and one boat they built, the *Helen Snow*, was named for the boat owner's daughter who was born in 1895 during the "deep freeze" when the bayou froze and Houma was covered with 18 in of snow. The Boynes, as did others, built their boats out of cypress, which grew in abundance in the swamps of Terrebonne (Wurzlow 1985:V:33).

Table 2-3. Commerce on Bayou Terrebonne for 1935 (CE 1936:630-631).

Domestic

In-Bound	Tons	Out-Bound	Tons
Animals and amimal products:		Animals and animal products:	
Fish	1	Dairy products	15
Lard	125	Lard	5
Milk, canned	188	Meat	33
Oysters, unshucked	2,553	Vegetable food products:	
Seafoods, canned	300	Flour and meal	10
Shells	2,600	Fruits and vegetables, canned	56
Shrimp, dried	117	Fruits and vegetables, fresh	50
Shrimp, fresh	2,397	Rice, cleaned	7
Shrimp, bran	147	Sirup and molasses	4
Vegetable food products:		Sugar, raw	8,352
Beans and peas, dried	1,100	Sugar, refined	16
Beverages	115	Sugarcane	5,322
Coffee	200	All other	25
Flour and meal	32	Textiles: Rope	4
Fruits and vegetables, canned	43	Wood and paper:	
Hay and feed	126	Cordwood	30
Oats	25	Lumber	2,000
Potatoes	75	Piling and poles	300
Rice, cleaned	125	Nonmetallic minerals:	
Sugar refined	120	Baroid	1,600
Sugarcane	15,677	Bunker oil	720
Textiles	17	Cement	800
Wood and paper:		Coal, anthracite	100
Logs, barged	457	Drilling mud	20,000
Paper and manufactures	19	Gasoline	459
Nonmetallic minerals:		Grease, lubricating	10
Bunker oil	7,060	Oil, crude	5
Oil, fuel and gas	2,056	Oil, fuel and gas	1,230
Oil, lubricating	160	Oil, lubricating	159
Sand and gravel	6	Salt	15

(continued)

Table 2-3. Concluded.

Domestic

In-Bound

	Tons
Ores, Metals and manufactures of:	
Iron and steel, manufactured	120
Iron and steel, rolled	800
Machinery and vehicles: Machinery and parts	1,201
Chemicals:	
Ammunition	32
Soap	150
Unclassified:	
Matches	22
Roofing	185
All other	393
Total	**38,744**

Value, $1,244,216

Out-Bound

	Tons
Ores, metals and manufactures of:	
Iron and steel, manufactured	450
Iron and steel, rolled	3,200
Machinery and vehicles: Machinery and parts	4,250
Chemicals:	
Explosives	20
Soap	3
Unclassified:	
Ice	2,671
Water, boiler	25,000
All other	1
Total	**76,922**

Value, $407,748

Up-Bound

Vegetable food products:	
Sugar, raw	6,000
Sugarcane	3,944
Total	**9,944**

Down-Bound

Vegetable food products: Sugarcane	3,661
Value, $16,474	
Total, all traffic	**129,271**
Value, $4,004,271	

A description of the old Boyne Boat Works is given in the following reminiscence by Ovide Bazet:

> This is my conception of the old Boyne Boat Works on lower Bayou Terrebonne at Madison's Canal in about the year 1910, at which time I was 10 years old. The boat tied to the wharf is the type they specialized in at that time. It was a wide semi-round bottomed boat with graceful curves . . . It resembled a large wide scoop with a box on top. There was barely enough space in the cabin for the gasoline engine. The boat was steered on the outside from the rear. There was a large, compartment in the front under the foredeck where the catch of shrimp, fish or oysters was stored in ice until it arrived in Houma. This compartment which was opened by a trap door on the deck was called the "hole". This boat was called a "lugger". In spite of the excellence of

Table 2-4. Trips and Drafts of Vessels on Bayou Terrebonne for 1935 (CE 1936:627-628).

Draft (feet)	Up-bound				Down-bound			
	Motor Vessels	Barges	All Other	Total	Motor Vessels	Barges	All Other	Total
6	3	157		160	3	157		160
5	172	138		310	172	138		310
4	224	121	3	348	224	121	3	348
3	656	48	1	695	656	38	1	695
2	129	11		140	129	11		140
Total	**1,184**	**465**	**4**	**1,653**	**1,184**	**465**	**4**	**1,653**
Total net registered tonnage	**5,706**	**33,077**	**265**	**39,048**	**5,706**	**33,077**	**265**	**39,048**

Section included: Terrebonne Bay to Terrebonne Bayou, 32.8 miles. Controlling depth: 5 feet. Project depth: 5 feet. Navigation season: Entire year.

> workmanship and its gracefulness in the water, the boat was built for hard work. It was designed to navigate the shallow lakes, bayous and bays of which the coast of Terrebonne Parish is noted. Using only hand tools, carpenters at that time took much pride in their work and regardless of the time involved to build a boat, excellence of workmanship took priority. Every boat could be called a work of art [Wurzlow 1985:V:35].

The Rhodes were another boat-building family in the area. Ernest Rhodes founded one of the first and largest boatways along Bayou Terrebonne at the turn of the century. It was located about a mile below Bush Canal. Ernest was the oldest of four brothers, the others were Frank, Gustave and George. They were the sons of Thomas Rhodes, who was a sea captain. Ernest had seven sons and two of them, Elie and Lawrence, also, became boat builders. Elie worked for the Houma Boat Company, a branch of the Higgins Boat Company of New Orleans building P-T boats, landing boats and Navy boats during World War II. Elie Rhodes built many boats after World War II himself, all out of cypress. He considered cypress to be the best boat wood, noting that "Nothing beats cypress for boats. No other wood will take the water like cypress. Another thing, good cypress does not have as many knots in it as other woods. Wherever a limb grows out, you will find a knot in the wood. When cypress trees grow close together in the swamp, they grow up tall before the limbs come out" (Wurzlow 1985:V:37). By the 1950s, when Elie could not find good cypress anymore, he went into the fishing industry catching fish and shrimp and harvesting oysters

Navigation Improvements

The importance of water transportation in Terrebonne Parish led to early attempts to improve navigation in the region. By 1823 Terrebonne landowners were required by law to keep clear a 10-ft-wide channel along bayous bordering their lands (Watkins 1937:114). In 1825 a man-made connection had been cut from Bayou Lafourche to Bayou Terrebonne. This canal greatly improved regional shipments of goods, although it was limited to shallow-draft vessels. This canal was later filled, but in its day it contributed to the movement of produce, such as, molasses, moss and sugar through the wharfs at Thibodaux (Rogers 1976). Between 1840 and 1945, numerous water courses intended primarily for transportation were built and natural waterways were improved. These canals provided convenient inland routes between the Lafourche and Terrebonne regions and New Orleans, allowing many shippers to avoid the often hazardous journey through the Gulf of Mexico (Davis 1973)

Dredging was considered a standard means to improve navigation in the bayous and streams in the area, but other measures were also explored. An interesting observation noted in Bayou Teche was that steamer traffic had a direct effect on the movement of sediments in the channel, especially on the smaller or narrow streams. It was observed that:

> Side-wheel steamboats, such as are below New Iberia, and not above, are so constructed that there is a strong current from their wheels washing the bottom from some distance away from the mid-channel out to the banks, but no current at all in the middle, consequently the heavier portion of the material washed up is deposited in mid-channel behind the boat, and the swell of the boat, which is greater than that from a stern-wheel boat, washes the banks, and causes the widening of the surface. The stern-wheel boat spends the force of its engines on the one wheel at its stern, and the current from it washes up the bottom in the center of the bayou only, and the tendency of the heaviest part of the material washed would be to the more quiet water of the sides. So it would have a tendency gradually to improve the navigation, while the side-wheel boat far more rapidly destroyed it [CE 1880:1169].

Bayou Terrebonne was once an outlet of the Mississippi River via Bayou Lafourche, but due to a closure at Bayou Lafourche in the years prior to 1880, the upper bayou silted in and navigation above Houma became impossible. Below Houma, Bayou Terrebonne was tidally influenced and became a very important navigable waterway for the large plantations and smaller farms downstream. In a Corps of Engineers survey report in 1880, Bayou Terrebonne was examined in some detail in preparation of dredging the following years. The report notes that the roads along the bayou were useless for moving freight. The best avenue depended on the navigation of Bayou Terrebonne, which also connected with other bayous to get produce to market.

Dredging of the Bayou Terrebonne channel was initiated in 1881. Prior to dredging, the bayou at Houma was reportedly 40 ft wide and 4 ft deep, but at low water it was only 10 ft wide and 6 in deep (CE 1889:1508). As a result, all navigation at the upper end of Bayou Terrebonne was done at high tide. Above the entrance of Bayou Cane the channel was practically dry. The towboat *Harry*, stationed at Houma, sometimes ascended to the mouth of Bayou Cane during high water (CE 1887:1397). This towboat was about 18 ft wide and had a draft of only 18 in (CE 1891:1844). The 1881 dredging project created a 6-ft-deep channel below Houma. However, local drainage ditch discharges soon created shoals that again reduced water depths in the bayou. By 1885 only one or two small steamboats were able to travel the lower channel (CE 1885:1407). To alleviate the problem, dredging of a 4-ft-deep channel from the mouth to the railroad depot at Houma was begun and completed in 1887 (CE 1888:1250). By 1886, channel improvements were sufficient to allow one or two small steamboats to periodically run to Houma (CE 1886:1265).

During the later part of 1915, the dredge *Delatour* dug a channel from the St. Louis Cypress Company bridge in Houma to Bush Canal, the end of channel improvement. The channel was dug to a depth of 6 ft and a bottom width of 50 ft (CE 1916:2449).

The Houma Navigation Canal (HNC), which runs along the eastern side of the project area, was built by local interests in 1962 to provide a ship canal from the Intracoastal Waterway to the Gulf of Mexico. The HNC has served the oil and seafood industries and recreational needs of fishermen. When constructed in 1962, the channel dimensions were 15 ft deep and 150 ft wide. The total length of the canal was 40.5 mi, with 10 miles in Terrebonne Bay and 3.9 miles in the Gulf of Mexico. The River and Harbor Act of 1962 authorized maintenance of the canal. Maintenance of the canal by the Corps of Engineers was initiated in November of 1964. In 1973, the project dimensions of the HNC were increased to 18 ft deep and 300 ft wide (Birchett and Pearson 1998:20).

Shipwreck Potential of the Project Area

Birchett and Pearson (1998) provide information on several vessels which have been reported lost in the region around the project area. However, all of these seem to have gone down some distance from the project area, either offshore or on the barrier islands located to the south. A review of a variety of sources has discovered no reports of any wrecks occurring in or very near the project area. These sources include the site files of the Louisiana Division of Archaeology, the various WPA reports noted above, the automated wreck and obstruction records of the National Oceanic and Atmospheric Administration (known as AWOIS); the compilation of shipwrecks provided in Pearson et al. 1989; as well as pertinent cultural resources studies carried out in the region. In addition, several historic and modern charts and maps of the area were examined. The only one of these sources showing wrecks in the vicinity of the project area are the various editions of the nautical charts for the area. The most recent of these charts, the 1998 edition of Chart No. 11357, *Timbalier and Terrebonne Bays* (NOAA 1998) shows several wrecks in western Terrebonne Bay. These wrecks are shown in Figure 2-5. Two wrecks, designated by the symbol meaning exposed remains and annotated PA, or

"position approximate," are shown north of the project area. One of these is located on the south side of the Houma Navigation Canal about one mile north of the project area and the other is shown on a point of land on the western side of the entrance to Lake la Graisse. The identity of neither of these wrecks is known, but the wreck adjacent to the navigation canal was visible until quite recently. When observed at a distance by the author in 1998, this vessel appeared to be the largely deteriorated hulk of an iron barge. The remains of this vessel were not observed during the survey conducted in June 2000 and, according to information provided by the Louisiana Department of Natural Resources, some or all of this wreck as well as the wreck near the entrance to Lake la Graisse has been recently removed as part of a program of obstruction removal (Louisiana Department of Natural Resources 2000).

As seen in Figure 2-5 another wreck is shown a short distance southwest of the project area. This wreck is depicted with the symbol for a completely submerged wreck and with the annotation PA, meaning position approximate. Nothing is known about this wreck. Several other exposed and sunken wrecks are shown in Figure 2-5. Most of these are located south of the project area, in the vicinity of Wine Island, however one wreck is shown due west of the project area, just west of Bayou Petit Caillou. The identity of none of these wrecks is known. Although it is most probable that these wrecks represent relatively modern vessels, such as fishing craft or barges, it is always possible that any one of them could be a historic vessel. None of these wrecks will be impacted by the proposed construction in the project area.

Several unidentified obstructions, also, are shown in Figure 2-5. These could be debris or trash lost from vessels or they could be material related to oil and gas activity, such as pipe, pieces of platforms or derricks, etc. On the other hand, any one of them could represent the remains of a sunken vessel.

The previous discussions have provided information on the various types of vessels that used the waters in the vicinity of the project area. As discussed, the shallow waters of western Terrebonne Bay have limited the types of craft traveling the area to fairly shallow draft vessels until the recent construction of the HNC which has permitted larger tow boats and barges to cross the bay. Further, the discussions on landform changes in the project area indicate that a considerable portion of the project area was marsh or natural levee until about 1910, and a smaller amount of marsh occupied the project area into the 1980s. Thus, it seems most likely that any historic vessel lost within the project area will be one of these small, shallow draft vessel, such as a sailing or motorized lugger, shrimp boat or skiff. Luggers, particularly, were very numerous in these waters when oystering was a popular activity. It seems reasonable that boats of this type might occasionally have visited or pulled up to Point Meshe if it was an obvious and elevated piece of land, as it seems to have been in earlier years. It is even possible that Point Meshe represented a hazard to vessels sailing in southern Terrebonne Bay, particularly during bad weather and in a southerly or southeasterly wind. Given these conditions, vessels could have been blown ashore at Point Meshe and lost. The wrecks shown on the point of land at the entrance to Lake la Graisse and near Point Mast in Figure 2-5 are suggestive of the dangers that these protruding points of land present.

While this scenario of a vessel blowing ashore on Point Meshe is a possibility, it is considered that the overall wreck potential of the project area is low. Vessels may have visited Point Meshe or passed close to it, but there is no evidence that the distributary channel which produced this landform was ever sufficiently open to permit boat travel during the historic period. If the channel had been open and navigable, then small boats almost certainly would have traveled along it. Evidence from other navigable bayous in the area, even very small ones, shows that old and worn out vessels are commonly abandoned along their banks. Although abandonments are concentrated in areas where docks and other bankside facilities are located, they sometimes occur far from these settings. The lack of such a navigable channel through the project area eliminates this potential for abandonments.

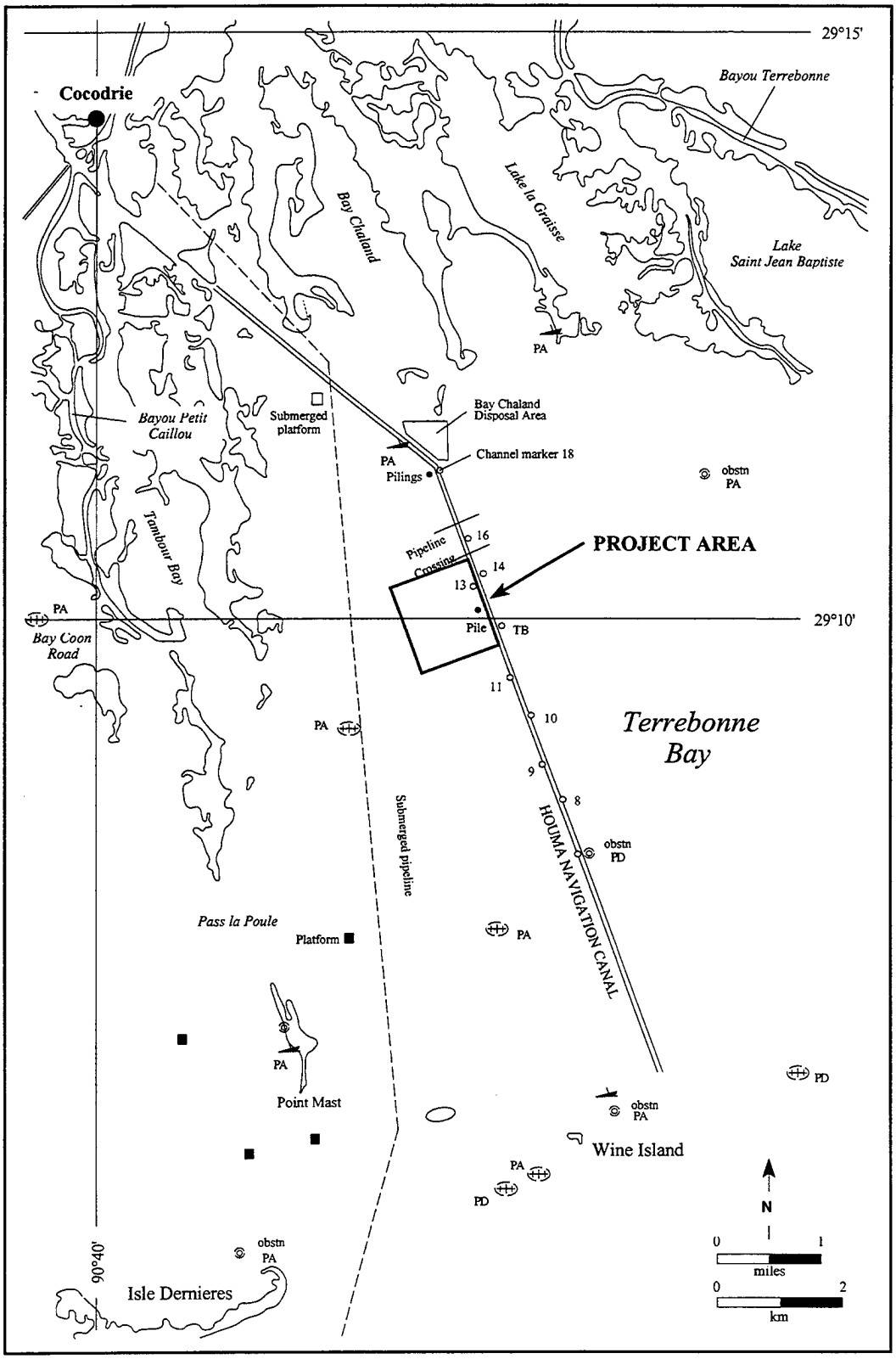

Figure 2-5. Wrecks, obstructions and other cultural features in the vicinity of the project area (NOAA 1998).

The Point Meshe distributary channel would have been open, and possibly navigable, at some time in the prehistoric period. The type of vessel that might have used the bayou then would have been the dugout canoe. However, discovery of early dugout remains in the project area would be difficult because they lack ferrous fasteners or other hardware which would be detectable by magnetometer. A canoe lying on the bottom might be detectable by side-scan sonar, but the layer of recent bay sediments covering the bottom in the project area would bury any canoe that might lie there.

Watercraft lost in the relatively shallow waters of the project area could have been exposed to some of the damaging effects of various natural processes, such as currents and wave action. Further, if vessels had come to rest along or very near the shoreline of the old Point Meshe landform, the processes of erosion that have totally removed this landform would almost certainly have had some adverse impact on the vessels. Any of these impacts could have broken up and scattered the structural remains of the watercraft. However, even if dispersion of wreck materials occurred, experience from other shipwrecks in similar settings demonstrates that larger and heavier items (e.g., ballast, hull pieces, iron fittings, etc.) might be only minimally displaced horizontally even though the vertical stratigraphy of the shipwreck may be compressed. Additionally, recent deposition of sediments onto the bay floor, derived from eroded marshlands, could have completely or entirely buried wreck remains. If so, these sediments would help create a low-oxygen environment at the wreck site, aiding in the preservation of organic materials. Exactly how stable these recent bay bottom deposits might be, however, is unknown. High seas in Terrebonne Bay would probably extend wave disturbances completely to the bay bottom in the project area, where depths are generally less than 9 ft. This wave disturbance, plus other currents in the bay, could easily move the soft and loose bayfloor sediments around, periodically uncovering and recovering wreckage lying on the bottom. Overall, the potential for the preservation of wrecks in the project area is considered low to moderate.

CHAPTER 3

FIELD INVESTIGATIONS

Research Methods

Research for this study entailed two phases of work; a background review of pertinent literature and field investigations; the latter involving a systematic remote-sensing survey of the project area. The background research consisted of a review of existing archaeological, historical and geological literature applicable to the project area. Particular effort was made to examine and collect information on the navigation history of the project area and the area's potential for containing the remains of historic vessels. As requested in the Scope of Work for this study (NOCOE 2000), this research concentrated on two previous works, the 1989 history of waterborne commerce and listing of reported wrecks within the New Orleans District by Coastal Environments, Inc. (Pearson et al. 1989), and the report on recent remote-sensing and diving operations undertaken along the Houma Navigation Canal at Cat Island Pass (Birchett and Pearson 1998). Given the extensive landform changes that have occurred in the vicinity of the project area, additional information on the area's geologic and geomorphic history was collected. This information aids in assessing the cultural resources potential (particularly in terms of watercraft remains) of the project area, both in terms of probable vessel losses and the potential for wreck preservation. Additionally, other sources were examined, such as the site files of the Louisiana Division of Archaeology, the Automated Wreck and Obstruction Information System (AWOIS) maintained by the National Ocean Service, and a variety of historic and modern maps. The information derived from all of these, and other, sources has been discussed in the previous chapter.

Remote-Sensing Survey

Survey Procedures and Methodology

Survey Design

The remote-sensing survey of the Houma Navigation Canal, Dredge Island Creation Project Area was conducted primarily to locate vessel remains. As discussed earlier, it was anticipated that the types of historic vessels most likely to have been lost in the area would be relatively small craft, such as luggers and skiffs, or more modern fishing vessels and commercial, such as shrimp boats or barges. The field survey was designed with the presumption that wrecks in the project area could exist either as scattered remains or as relatively intact vessels with minimal dispersal. Data interpretation relied on the same presumption.

The project area is situated on the western side of the Houma Navigation Canal and extends from about mile 5.5 to mile 6.2 along the canal. The area examined includes the proposed island creation area as well a 1,000-foot-long flotation channel leading from the Houma Navigation Canal to the creation area. This roughly square area measures approximately 4200 ft east-west and 4700 ft north-south and encompasses roughly 450 acres of water bottom. The eastern edge of the project area extends slightly into the dredged channel of the navigation canal. The Louisiana state plane coordinates (NAD 1983, Louisiana South grid) for the four corners of the project area are: 1) x=3,513,100; y=246,298; 2) x=3,514,721; y=241,860; 3) x=3510,779; y=240,418; 4) x=3,509,155; y=244,853.

The survey area falls within the moderately protected waters of Terrebonne Bay. Although somewhat protected, winds can become quite strong, particularly in association with rain squalls, such that weather-induced high seas are not unusual. As a consequence, close attention was paid to weather conditions during the survey. Commercial boat traffic along the navigation canal in the form of crew boats, shrimp boats, barges, etc., is relatively light, but did require attention when surveying was conducted in the area of the canal.

The entire project area was systematically surveyed along 43 transects spaced 100 ft apart and oriented parallel to the navigation canal (Figure 3-1). Each of these lines was extended a short distance beyond the boundary of the project area to insure complete coverage. Two additional transects were surveyed across the project area, perpendicular to the main survey lines. These two "tie lines" were positioned near either end of the project area. In addition, four short survey transects were run across the one target of interest recorded in the project area. Positioning control points were obtained and digitally stored every 100 ft along survey transects. Coverage of the project area entailed approximately 43 linear mi of survey.

The fieldwork was conducted between June 27 and 29, 2000. During this period, a three-person survey crew spent 36 hours conducting the survey. Field crew members consisted of Charles Pearson of Coastal Environments, Inc., and Lon Theriot and Scott Haydel of C&C Technologies, Lafayette, Louisiana.

Remote-Sensing Equipment

The remote-sensing equipment used consisted of a fathometer, magnetometer and side-scan sonar, provided by C&C Technologies of Lafayette, Louisiana. The survey vessel utilized was the 26-ft, aluminum boat *Inland Surveyor* with a fully enclosed cabin and powered by two, 130 horsepower outboard motors. The fathometer used was an Odom Echotrac which was mounted at the stern of the survey vessel immediately beneath the GPS antenna (Figure 3-2). Although used primarily to obtain water depths, the fathometer would record information on any cultural features that might extend above the bottom, plus it provided some data on the characteristics of the bay bottom. Generally, the fathometer signal displayed a relatively "soft return" with a small amount of subbottom penetration, normally an indication of a soft or loose bottom.

The magnetometer used was a Geometrics Model G-880 cesium magnetometer with a strip chart printout recorded on the 100/1000 gamma scale with readings collected every 1 second. The magnetometer sensor was towed 100 ft behind the survey vessel, beyond the magnetic influence of the boat (see Figure 3-2). The distance from the positioning antenna to the magnetometer sensor was 100 ft and this offset was considered and adjusted during the production of the computer-derived maps for this study. Because of the shallow water, a float was put on the magnetometer tow cable which kept the sensor at, or just below, the water surface. This placed the sensor from 5 to 8 ft or so above the bottom in all of the project area except for the small segment falling within the navigation canal itself. Even in this deeper area, the sensor was within 13 or 14 ft of the bottom.

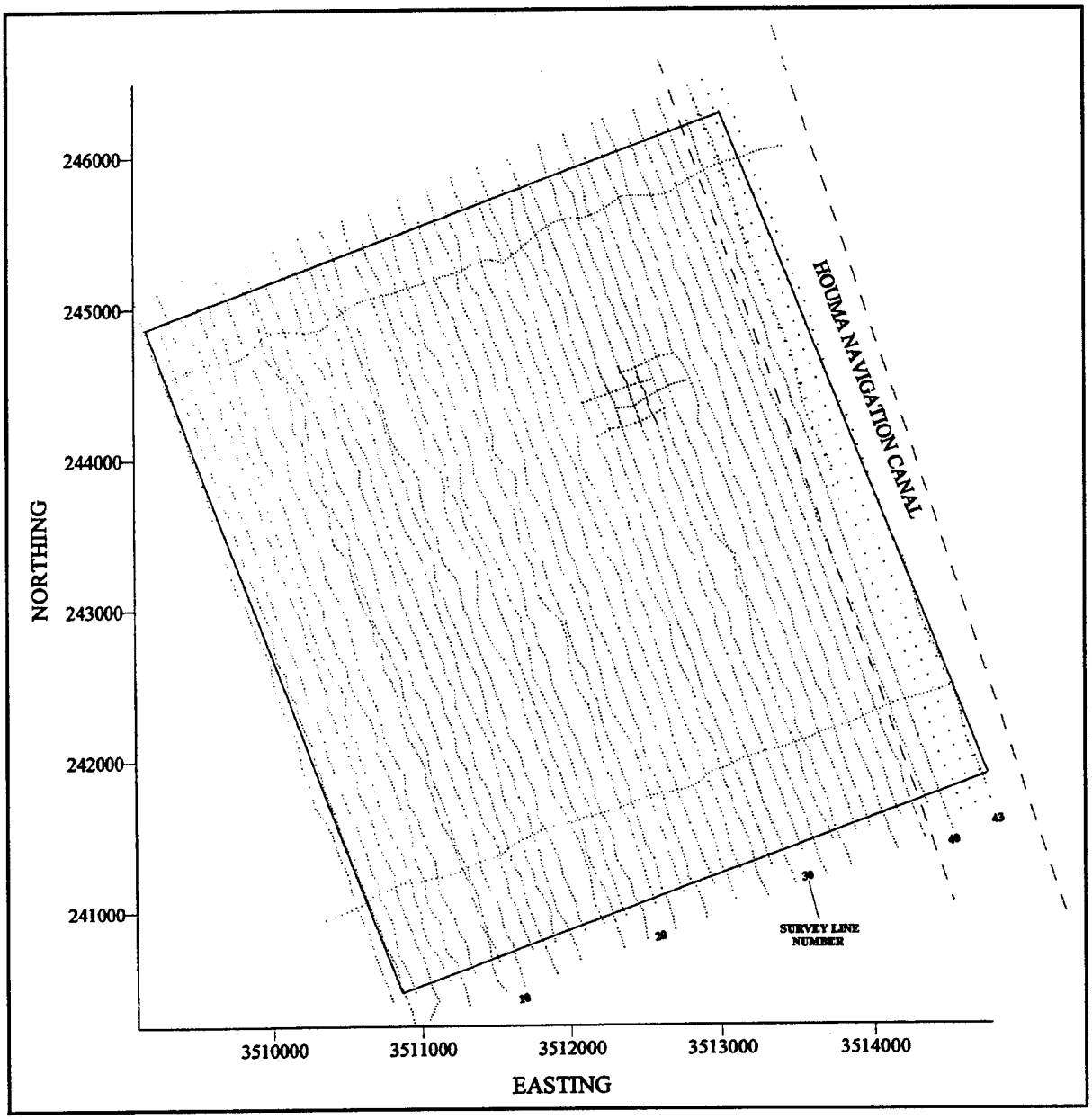

Figure 3-1. Survey vessel tracks in the project area.

The side-scan sonar used was a marine EdgeTech Model 272-TD sonar operated at 100 kHz and on a 25-meter scale. The shallow water of the project area (circa 6 to 15 ft) necessitated the narrow (i.e., 25 m) beam width. The side-scan sonar sensor was towed off the bow of the boat at a depth of 3 ft below the surface (see Figure 3-2).

Positioning is a critical aspect of any remote-sensing survey of this type. Accurate positioning is essential when running survey lines and for returning to selected locations for supplemental remote-sensing operations or subsequent underwater investigation of targets. Positioning during the survey was provided by a Trimble Model 4000 DGPS (Differential Global Positioning System) employing a Northstar antenna to collect the differential signal.

DGPS systems are now in common use and well known to the archaeological community such that they require little discussion or explanation. The Trimble system, in conjunction with the navigation software program *Winfrog* used during the survey, allows for real-time navigation and data storage with positioning errors on the order of +/- 3 m. The Trimble Model 4000 with the Northstar antenna automatically selects the available differential signal that is most accurate; in the present instance the differential beacon at English Turn was most commonly utilized by the system. Coordinate data were collected in the Louisiana South State Plane system (NAD 1983, Louisiana South grid).

The magnetometer, fathometer and positioning systems were connected to an onboard computer and all of these data were digitally collected and stored during the survey using the navigation program *Winfrog* by Racal. In addition, all of the remote-sensing systems were connected to strip chart recorders that provided real-time, hard copy records which the crew could observe and monitor during the survey. The survey was conducted at a vessel speed of approximately 4 to 4.5 miles per hour.

The *Winfrog* program provides the capabilities of automatically designing and storing preplotted survey lines which are displayed visually on a computer screen for the boat captain to use for steering. In the present survey, these preplotted lines were spaced 100 ft apart and contained control points every 100 ft. During operation, *Winfrog* receives the DGPS positioning information and displays this as the vessel position in relationship to the preplotted survey lines, enabling the boat captain to steer along these lines. *Winfrog*, also, is capable of storing collected data from several peripheral instruments in addition to the DGPS, in this instance from the fathometer and magnetometer. The magnetic and fathometer data were downloaded in digital format and stored as numeric data files. During the collection of data, *Winfrog* automatically attaches real-time DGPS coordinates to each magnetometer and fathometer reading, ensuring precise positioning control. During post-processing *Winfrog's* positioning files can be converted to data files containing the X, Y, and Z values needed to produce magnetic and bathymetric contour maps. In this instance, these data files were used in the program SURFER to produce the bathymetric and magnetic contour maps presented below.

Data Interpretation

Overall, the data collected during the survey was of very good quality. This was particularly true of the magnetometer data, because of the use of a cesium magnetometer. The cesium magnetometer tends to be much "quieter" than the proton precession magnetometer and this was evident in the data collected during the present study where background noise rarely exceeded +/- 2 gammas. On one afternoon, winds associated with a passing rain squall produced high waves that resulted in a deterioration of the collected data. In this instance, the survey was stopped until the squall passed and seas calmed.

The side-scan sonar records provided a good picture of the bottom in the project area, indicating a generally flat surface devoid of features. In terms of cultural resources, interpretation of side-scan sonar records is fairly straight forward, in the sense that, generally, dense objects (such as metal or wood) are good reflectors and produce a darker image on the record that contrasts with the return from the bottom (Fish and Carr 1990). Garrison et al. (1989:223) note that side-scan sonar images of shipwrecks tend to be geometrically complex, exhibit scouring, and are associated with magnetic anomalies, while isolated pieces of modern debris tend to produce geometrically simple images. A small number of "hard return" targets were observed on side-scan records; although none were extremely distinctive and none displayed the "geometrically complex" shape expected for pieces of wreckage. The majority of these targets are located in and adjacent to the Houma Navigation Canal (principally on survey lines 35 to 43) and in the vicinity of the set of three pipelines that lie just outside of the northern boundary of the project area. These targets are all quite small and are believed to represent

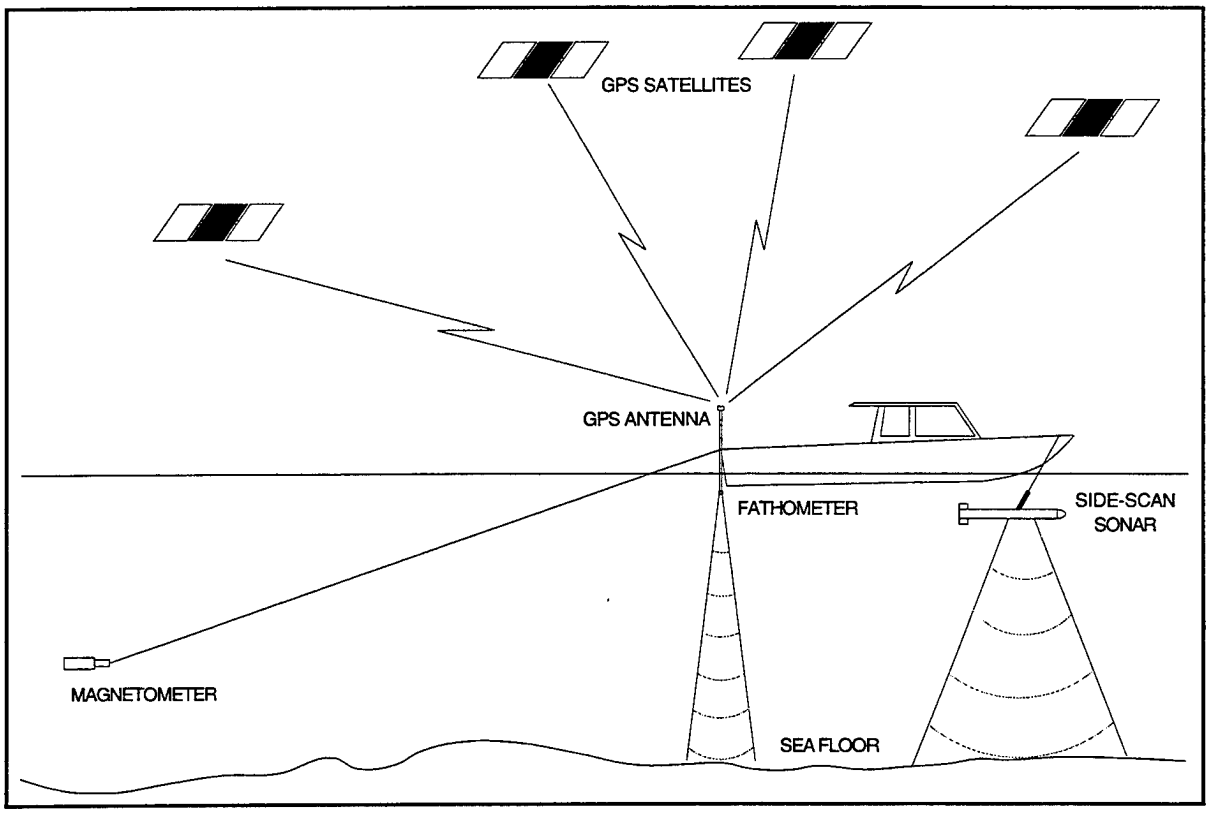

Figure 3-2. Deployment of the remote-sensing equipment during the survey.

small pieces of metal, probably debris and/or trash (pipe, cable, chain, etc.) lost from fishing, commercial or recreation vessels or from maintenance, repair or construction activities associated with the pipelines. Figure 3-3 shows a rather typical one of these small, unidentified, "hard return" targets. None of these targets are considered to be significant cultural properties.

The side-scan sonar records, also, displayed a number of "drag marks" produced by shrimp net doors as they gouged into the relatively soft bottom of the study area. In fact, during the survey, several shrimp boats were dragging in and near the project area. Figure 3-3 shows a set of these drag marks.

Magnetometers are now accepted as critical and standard pieces of equipment in the search for sunken vessels. They have been widely used in marine as well as riverine settings in the New Orleans District, including many settings similar to the present study area. Discussions on the use of magnetometers in archaeological research and the theoretical basis for interpreting magnetic data can be found in Aitken (1958), Breiner (1973), Green (1970), and Weymouth (1986). Additionally, a number of studies provide discussions on the specific application of the magnetometer in the search for shipwrecks and the practical aspects of interpreting magnetic data collected in these studies. Particular efforts have been made at characterizing the types of magnetic signatures created by shipwrecks (e.g., Clausen 1966; Clausen and Arnold 1975; Irion 1986; Irion and Bond 1984; Murphy and Saltus 1981; Watts 1980, 1983).

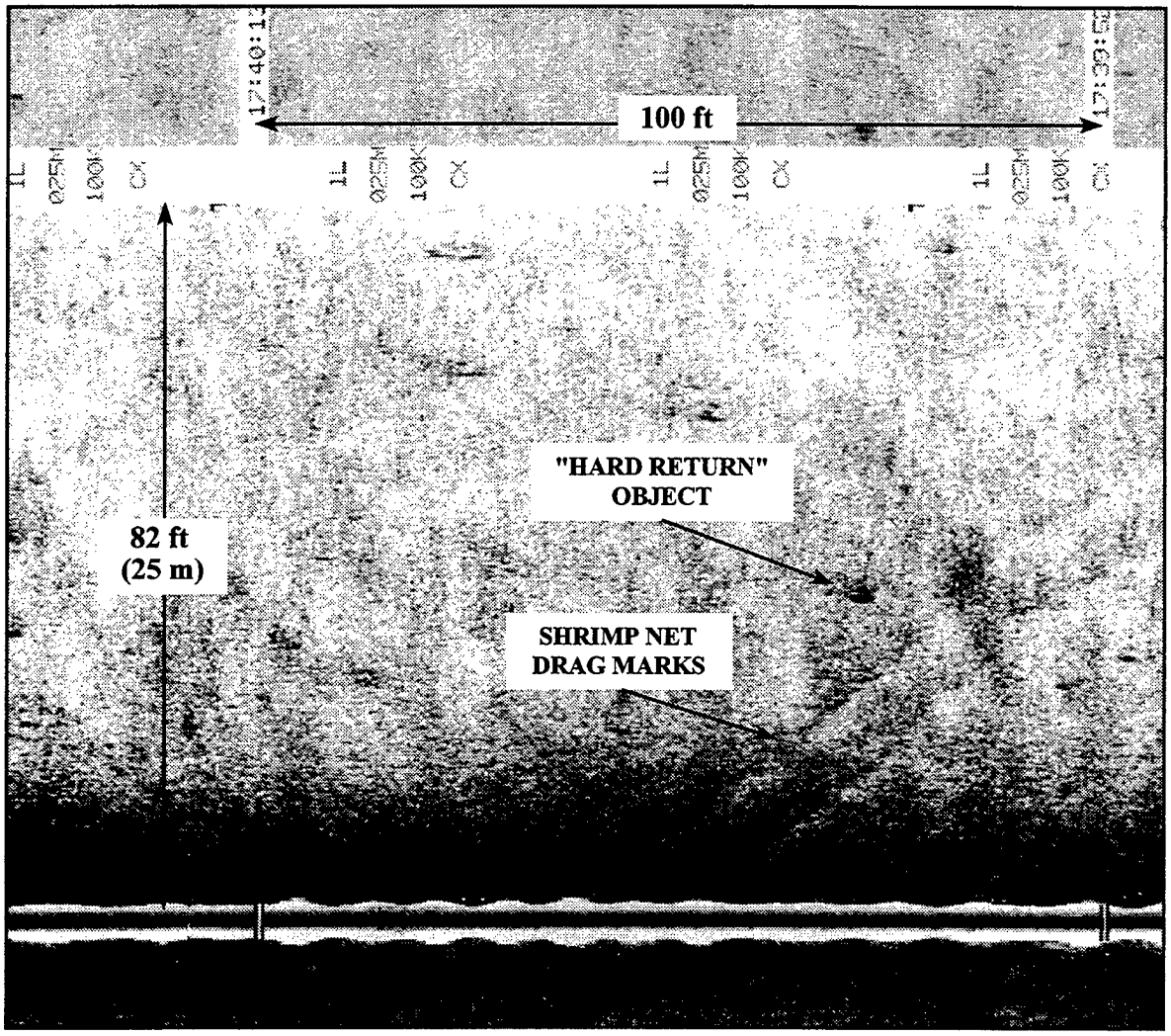

Figure 3-3. Side-scan sonar record from the project area showing small, "hard return" object and drag marks from a shrimp net. Location = Line 38, positioning points 8 to 9.

The magnetometer measures the strength of the earth's magnetic field in increments of nanoTeslas or gammas. A great variety of types of objects produce distortions in this field, generally called "anomalies." Magnetic anomalies produce "signatures" that can be characterized by two nonexclusive factors: strength (intensity) and shape, both of which are dependent upon a variety of factors related to anomaly source characteristics. These characteristics include the composition, size, shape and mass of the source object; its magnetic susceptibility; and its distance from the point of measurement. Magnetic anomalies can be caused by natural as well as man-made features. Anomalies caused by a single-source, ferrous object typically produce a positive-negative anomaly pair known as a dipole. The dipole is usually oriented with the axis of magnetization, with the negative reading falling nearest the north pole of the source object. The positive anomaly reading is commonly of greater intensity and area than is the negative.

Although a considerable body of magnetic signature data for shipwrecks is now available, it is impossible to positively associate any specific signature with a shipwreck. The

variations in the iron content, condition, and distribution of a wreck all influence the intensity and configuration of the magnetic signature produced. Also, the manner in which the magnetic data are collected affect the characteristics of the signature. Despite these problems, shipwreck remains do tend to exhibit characteristic magnetic signatures that often aid in differentiating them from other types of anomalies. Historic shipwrecks, because they generally contain numerous ferrous objects, commonly will produce a magnetic signature composed of a cluster of multiple anomalies (both dipoles [i.e., pairs of magnetic highs and lows] and monopoles [i.e., a single magnetic high or low]), normally with differing amplitudes. Often referred to as a "complex" magnetic signature, this characteristic was recognized in the 1960s by Clausen (1966) and Clausen and Arnold (1975:129) who noted that the wrecks of sailing vessels in Florida and Texas produced magnetic signatures with "a central area of magnetic distortion characterized by a number of intense and generally localized anomalies surrounded. . . [or] interspersed by scattered, smaller magnetic disturbances." Others (e.g., Watts 1980, 1983), however, have demonstrated that a shipwreck can generate much less complex magnetic signatures, sometimes simply a broad-based anomaly of less than 25 gammas. This does occur, but the distance of the sensor from the source object is a major influence on the complexity of the signature. The farther away the sensor is, the less likely the anomaly will be "complex" because the sensor is reading the wreck as a single large object and does not discern individual and possibly dispersed elements of a wreck.

A study conducted by Garrison et al. (1989) for the Minerals Management Service, United States Department of the Interior, attempted to develop an interpretative framework to help discriminate between the magnetic signature characteristics of modern debris and those of historic shipwrecks in the Gulf of Mexico. They argue that the relationship of magnetic signatures and spatial distribution is at the core of distinguishing the magnetic signatures of shipwrecks from non-wreck ferromagnetic debris (Garrison et al. 1989:214). One of the characteristics of shipwreck anomalies noted by Garrison et al. (1989:222-223) is that a typical signature will cover an area between 10,000 and 50,000 square meters. However, their estimates are related primarily to larger vessels lost in the Gulf of Mexico. Smaller vessels, such as those that traveled the waters of the project area, are known to produce signatures of a smaller size. Even these smaller vessels, however, are likely to produce a characteristic multiple (i.e., "complex") anomaly signature which will be recorded on more than one survey line, assuming lane spacing of not more than 100 ft or so. Generally, these broad, complex signatures are distinguishable from the individual anomaly signature that is characteristic of modern pieces of debris (barrels, pipes, pieces of cable, etc.). It should be emphasized, however, that complexity is partially dependent upon distance from the source as is noted above. A magnetic anomaly recorded when the sensor is close to a shipwreck may exhibit a complex configuration, because individual ferrous objects are detected; however, at a greater distance the signature may resemble a single dipole because the entire wreck is being recorded as a single-source object.

As noted, the multiple magnetic anomalies of shipwrecks tend to exhibit differential amplitude, principally reflecting the variability in size, composition, and mass of the ferrous elements of the shipwreck. Some non-shipwreck objects, such as a long length of cable, may produce a multiple anomaly signature covering a fairly large area, but the anomalies will customarily show a uniformity of amplitude, distinct from the variability seen in shipwreck signatures (Garrison et al. 1989:122).

In general, the magnetic signatures of watercraft of modest to large size will range from moderate to high intensity (greater than 50 gammas) when the sensor is at a distance of 20 ft or so. Additionally, wrecks of these moderate-sized vessels tend to produce signatures that are greater than 80 or 90 ft across the smallest dimension. While recognizing that a considerable amount of variability does occur, this information establishes a beginning point for the identification of the sources of the magnetic anomalies in the project area. Additionally, it must

be remembered that very small boats, or those containing little ferrous material, such as the small folk craft commonly used on the inland and bay waters of Louisiana, may not be detected by a magnetometer when survey line spacing is on the order of 100 ft, such as used in this survey.

During the survey, with survey lines spaced 100 ft apart and with the magnetometer sensor at or near the water surface, objects lying on or near the bottom would have been from as near as 5 ft to as far as about 52 ft from the sensor. This greatest distance would only have been in the extreme eastern part of the area where water depths in the Houma Navigation Canal reached as much as 15 ft (This assumes a maximum water depth of 15 ft and a maximum horizontal distance of 50 ft to an object lying on the bottom.) However, in the majority of the area surveyed water depths were on the order of 8 ft deep, meaning the sensor would have been much less than 50 ft away from objects lying on the sea bottom. The remains of a small to average-sized vessel (presuming a vessel containing some amount of ferrous material) should create an obvious magnetic signature at these relatively short distances (see Garrison et al. 1989). In light of this, anomalies that were less than 40 gammas in strength were eliminated from consideration as possible wrecks unless other factors suggested otherwise. These other factors included occurrence of the same magnetic anomaly on adjacent survey lines and the occurrence of a cluster of individual anomalies forming a spatially distinct signature.

The majority of the magnetic anomalies recorded in the project area were characterized by low gamma signatures (less than 20 or 30 gammas) of short duration. These anomalies consisted of monopoles, or a single high or low reading, as well as simple dipoles, consisting of a paired magnetic high and a low. Figure 3-4 shows a typical low amplitude dipole anomaly, a number of which were recorded in the study area. Indicative of small, single source objects, these anomalies are presumed to represent isolated pieces of debris and were not afforded further evaluation.

In summary, the evaluation of the remote-sensing data relative to their potential for representing a possible shipwreck relied on a variety of factors including overall target characteristics (e.g., side-scan image type, magnetic anomaly gamma strength, duration and form), association with other side-scan or magnetic targets on the same or adjacent lines, and relationship to observable target sources (i.e., channel markers, pipeline piling markers, etc.) which were noted on the magnetometer and side-scan records. Because the sonar record gives a visible indication of the target, identification or evaluation of potential significance was based upon target shape, size and configuration, as well as association with magnetic targets.

The Results of the Remote-Sensing Survey

As noted, the bottom in the project area was relatively flat, except where it slopes down into the maintained channel of the Houma Navigation Canal. Additionally, the bottom slopes very gradually from north to south. Figure 3-5 presents a contour map of the bathymetry of the project area in 1-ft contour intervals produced with the program SURFER. An example of fathometer record is shown as Figure 3-6. This record shows the very flat bottom, plus it indicates that the fathometer beam achieved a small amount of penetration into the bottom, suggesting relatively soft sediments. The only obvious features on the bay bottom were the shrimp net drag scars mentioned earlier.

Figure 3-7 presents a SURFER-derived magnetic contour map of the project area. The contour interval is 40 gammas and the vessel track lines are shown. The linearity seen in some of the magnetics is related to diurnal fluctuation, a product of the long duration of the survey. Diurnal variation refers to the daily shift in magnetic field strength that occurs over the course of a day. This shift normally varies in the tens of gammas over a given day, but can be considerably more when effected by sunspot activity (Weymouth 1986:346). Diurnal

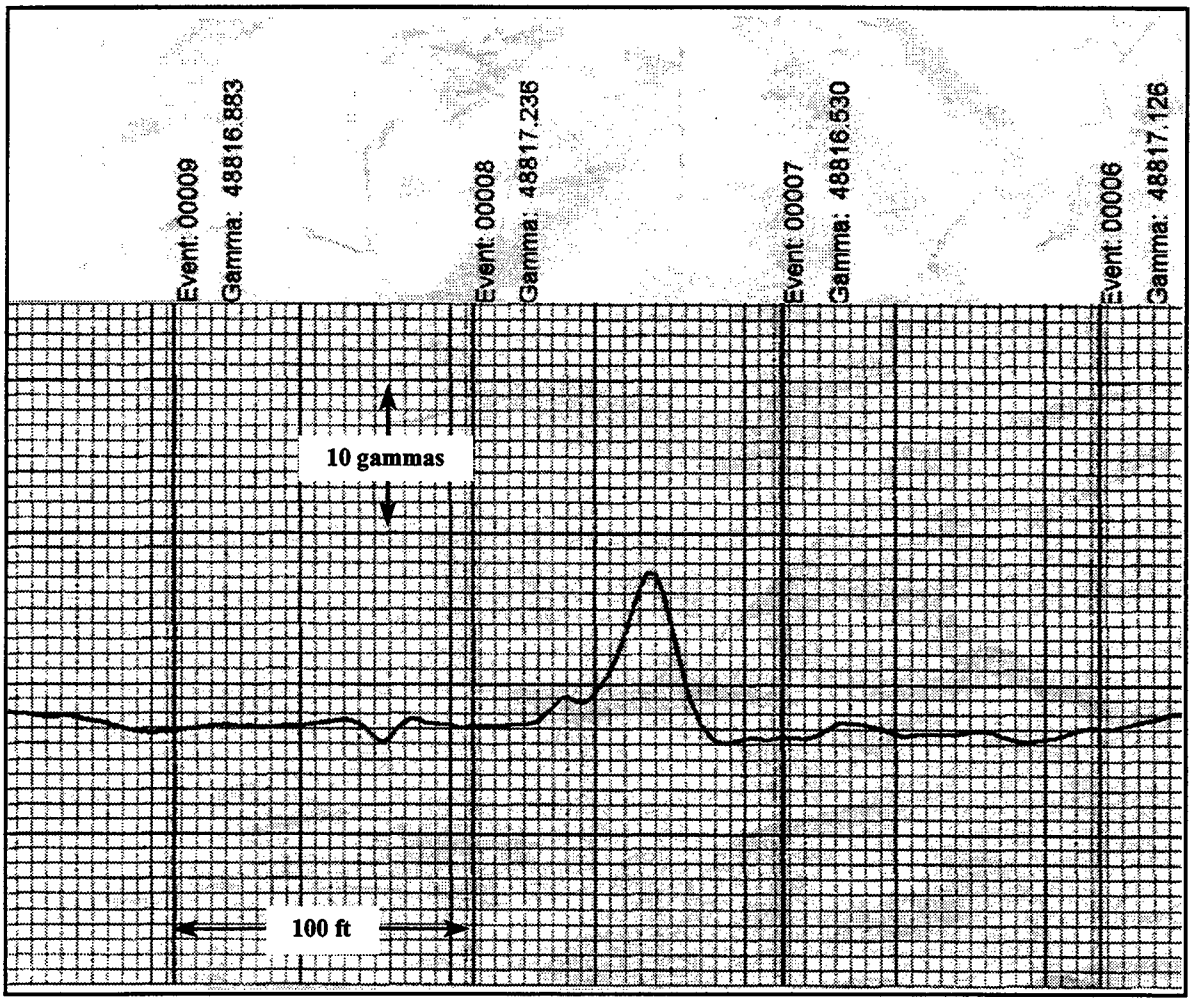

Figure 3-4. Magnetic anomaly of low amplitude (11 gammas) and short duration typical of that produced by individual pieces of ferrous debris. Location = Line 36, positioning point 7.5.

fluctuation can be corrected by several methods; one of the most common is to use a base station to take readings continuously or periodically over the duration of a survey and then using the base station readings to correct diurnal fluctuation obtained during the survey. Another technique is to mathematically manipulate the raw magnetic data to remove or, at least, minimize the effects of diurnal fluctuation, usually involving corrections to individual lines or by averaging all of the data in some manner (e.g., adjusting raw data with a "running average"). In the present instance it was determined that the diurnal fluctuation did not adversely effect the interpretation of the magnetic data because the absolute field-strength was not the critical concern. Rather it was the difference among magnetic readings over relatively small areas that was of importance. Given the principal targets of interest in the project area (e.g., historic wrecks), it can be assumed that the magnetic gradients produced by these objects will be much more intense over short distances than will diurnal shift and, thus, can be easily distinguished in the contoured data.

As can be seen in Figure 3-7, several magnetic signatures of greater than 40 gammas do appear. Two of these, recorded on survey lines 21 and 24, were recorded on single lines, but

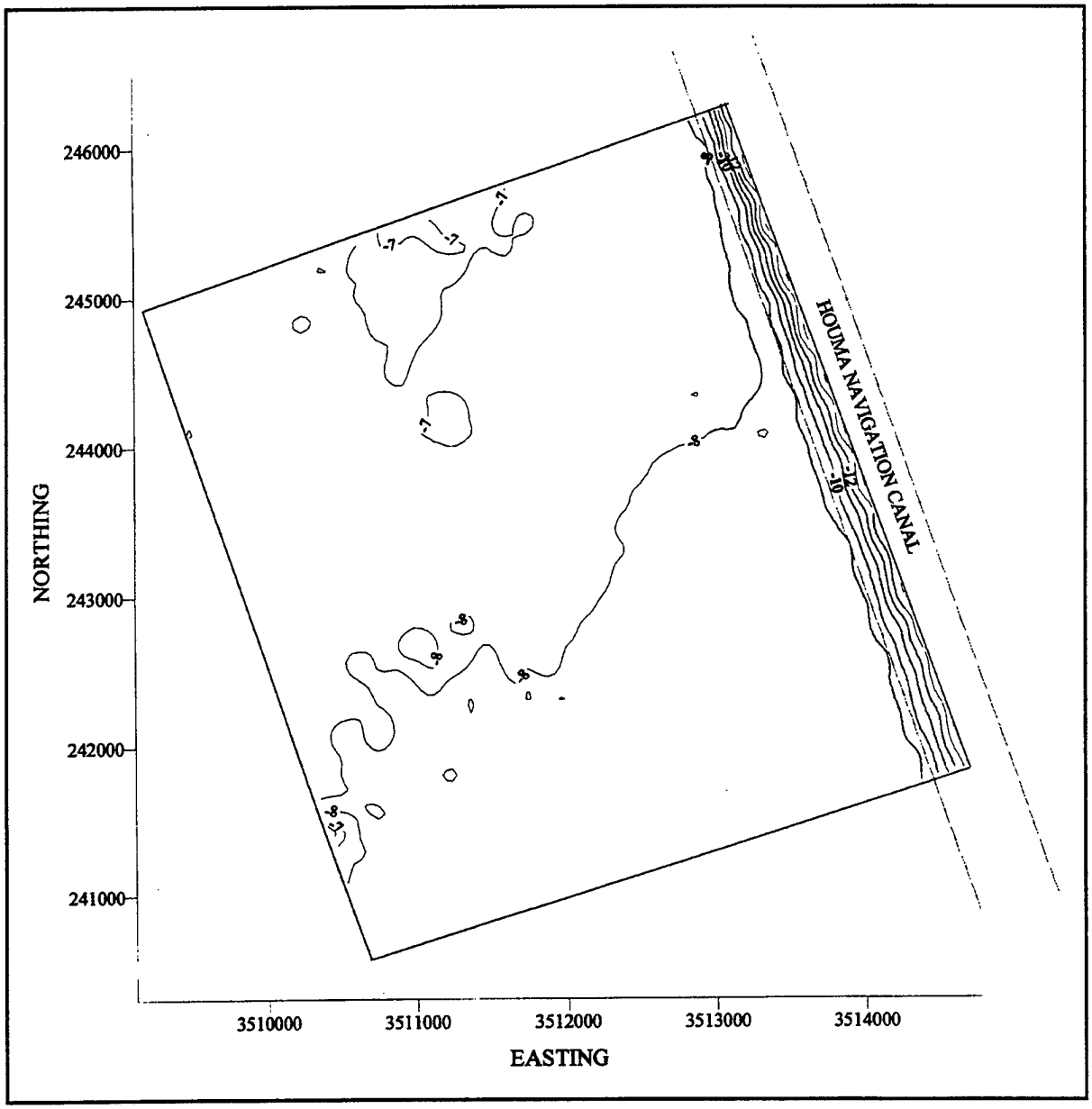

Figure 3-5. Bathymetry in the project area. Contour interval is 1 ft. Grid is state plane coordinates, NAD 1983, Louisiana South.

the contouring program throws the contour lines out some distance, such that the signature appears to extend across more than one line. In addition to these two anomalies, a number of less than 40-gamma signatures were recorded on individual survey lines. It is believed that the sources for this class of magnetic signature are individual pieces of modern debris, most of which have been accidentally lost or purposefully thrown from commercial and recreational vessels using the area. As noted, the majority of these were recorded in and near the Houma Navigation Canal along the eastern edge of the project area, where vessel traffic is concentrated. As such, most will likely represent debris resulting from commercial vessel activity on the canal. These types of objects are not considered to be significant cultural properties.

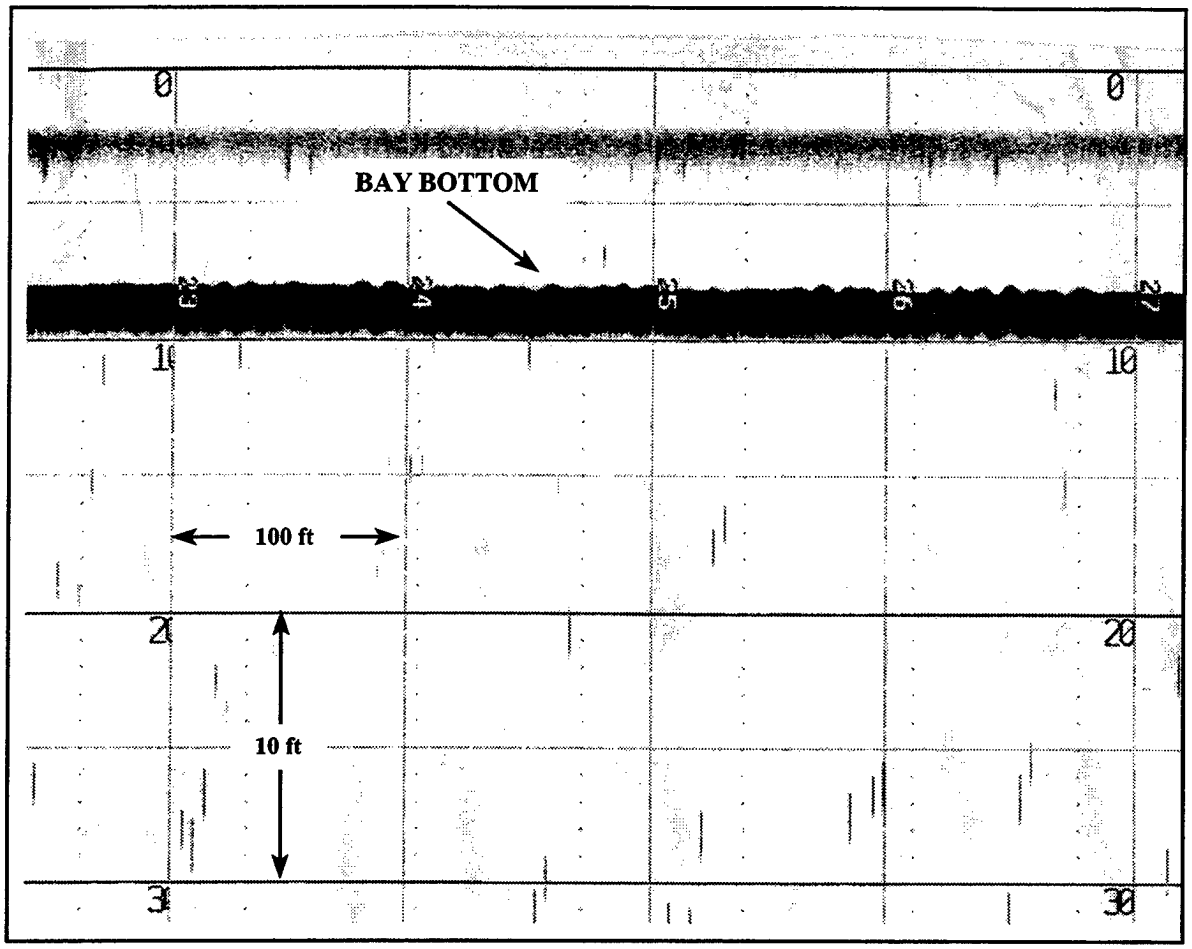

Figure 3-6. Example of fathometer record collected in the project area. Location = Line 24.

A relatively intense magnetic anomaly was recorded on the northeastern corner of the project area, at the northern ends of survey lines 38 and 39 (see Figure 3-7). This anomaly is associated with a cluster of pilings located very near, but just outside of the project area that are marking the pipeline crossing here. The magnetics are believed to be associated with iron bolts, cable, etc., used to connect the pilings together which have fallen into the water over the years, as well as debris derived from vessels which anchor at or tie up to the pilings. In fact, while the survey was being conducted, a small, recreational fishing boat was tied to this group of pilings. This is a common occurrence and a variety of types of ferrous trash and debris have probably been lost or thrown overboard from these boats, all of which would contribute to the magnetics recorded here.

Another object recorded in the project area is Channel Marker 13, marking the western side of the Houma Navigation Canal (see Figure 1-1). This marker produced only a small magnetic anomaly, but it was visible on side-scan sonar records on two survey lines.

Target 1

The in-field analysis of the collected data identified a single target that was deemed a "target of interest." This target, designated Target 1 and recorded along survey line 30,

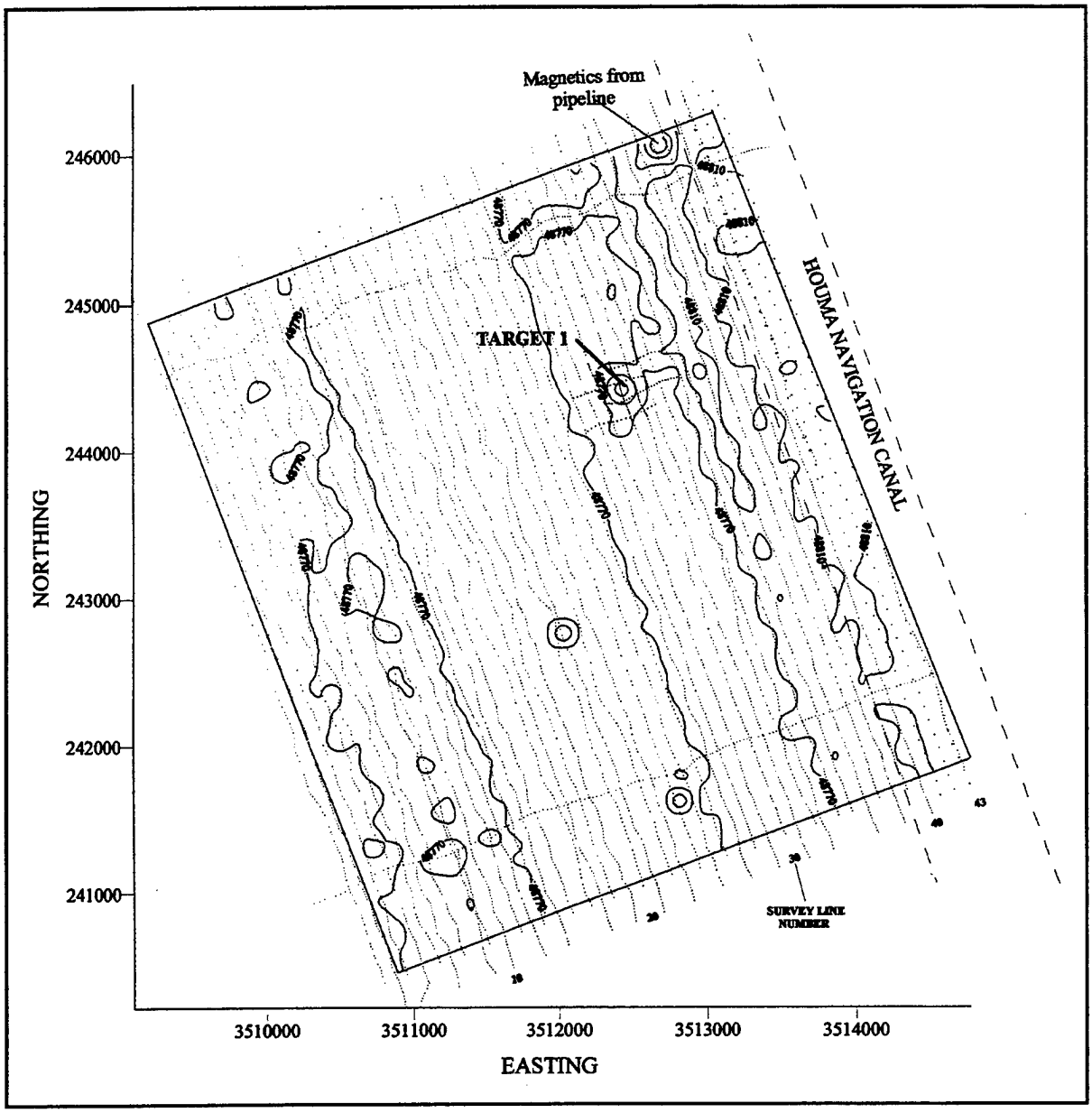

Figure 3-7. Magnetic contour map of the project area. Survey vessel tracks are shown in gray. Contour interval = 40 gammas. Grid is state plane coordinates, NAD 1983, Louisiana South.

displayed some, but not all, of the magnetic characteristics that are generally associated with shipwrecks. For example, it exhibited a fairly intense magnetic signature, in this instance over 200 gammas, and it appeared to cover an area greater than 100 ft along a single survey line. The magnetic anomaly did not, however, appear to extend to adjacent survey lines, nor did it display the "complex" signature (i.e., one producing multiple highs and lows of differential amplitude) typically characteristic of shipwreck remains. In addition, no associated features were seen on side-scan sonar or fathometer records. Despite the fact that this target lacked many characteristics of typical shipwrecks, it was the only target in the project area which displayed even minimal resemblance to a wreck and it was decided to examine it in more detail.

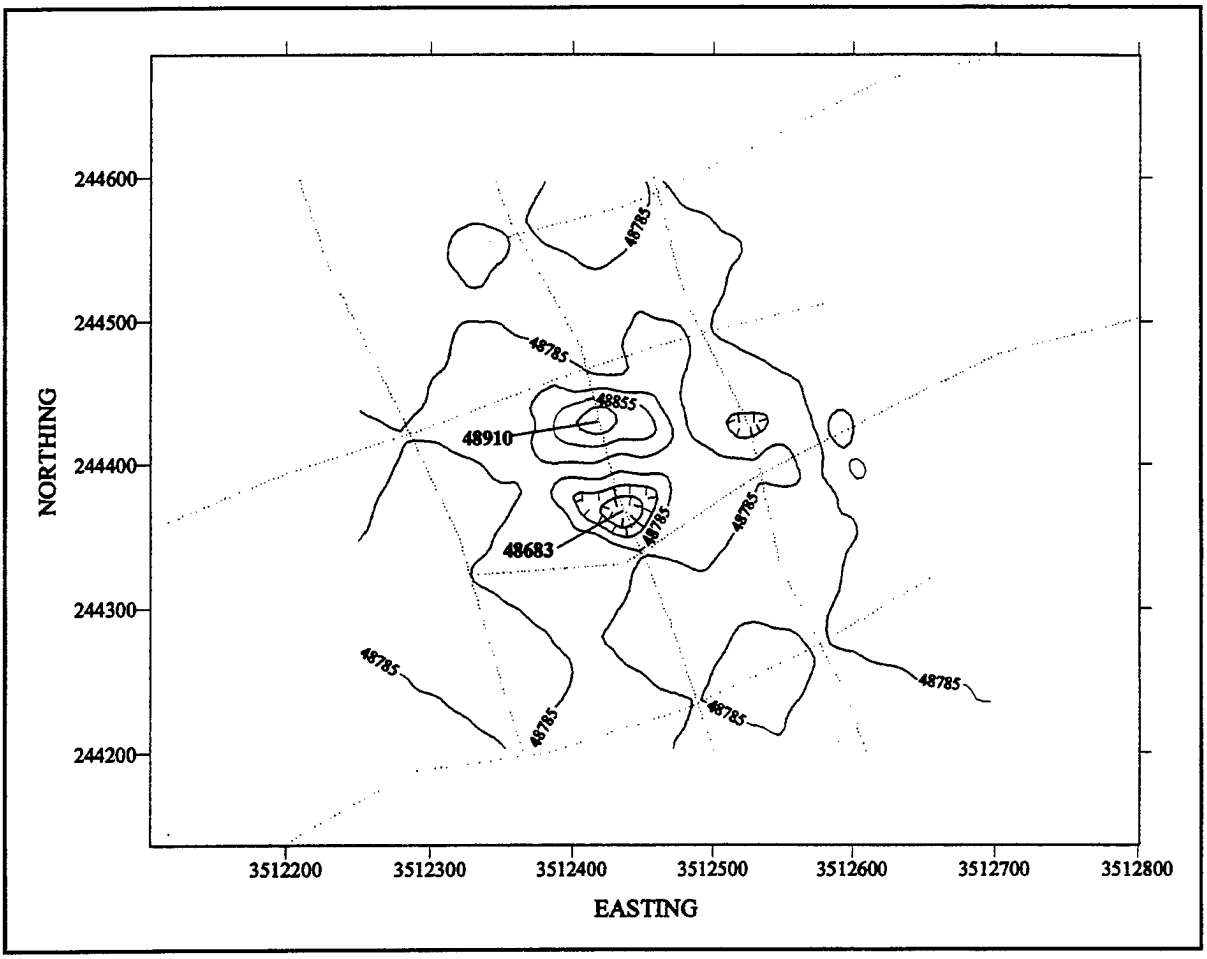

Figure 3-8. Magnetic signature of Target 1. Survey vessel tracks are shown. Contour interval = 35 gammas.

Four additional survey transects were run over Target 1, perpendicular to the original survey lines, as shown in Figure 3-7. The magnetic data collected at Target 1 was contoured with the program SURFER (Figure 3-8). When contoured, it was apparent that this magnetic signature is a simple dipole, consisting of paired high and low readings, with a maximum intensity of 227 gammas. The signature, although approximately 100 ft across, was recorded on only a single survey line. Thus, it appears that the source for Target 1 is a single object, essentially located along or very near the track of survey line 30. No object was recorded on side-scan sonar records at this location, suggesting that the source object is buried.

Normally, the source object for a magnetic dipole is located about half way between the high and low reading, and it is assumed that this will hold true for Target 1. This means that the state plane coordinates for the source of Target 1 are: x (easting) = 3,512,428; y (northing) = 244,395. However, Target 1 does differ from the classic magnetic dipole in that the magnetic low is positioned to the south and the high to the north. For a compact source object, it is normally the reverse, with the low to the north (Breiner 1973). Linear objects, however, because they can develop magnetic polarity and, essentially, form large magnets do not always follow the rule of the magnetic low to the north. Thus, it is believed that the object producing the Target 1 signature is likely to be linear in shape and does not represent significant shipwreck remains. Although the specific identity of Target 1 is unknown, it is interesting to

speculate that it could represent the United States Geological bench mark named "Point Meshe" that was once located on the remnant distributary landform which extended into the project area. This bench mark is shown on several quadrangle sheets of the area and it is likely that it simply sank to the bottom when Point Meshe was finally washed away.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

The remote-sensing survey of the Houma Navigation Canal, Dredge Island Project Area, recorded a small number of magnetic anomalies and side-scan sonar targets. None of these targets can be identified as historic shipwreck remains or other significant cultural properties and most are believed to be scattered pieces of modern debris. These findings, generally, support the information collected on the past navigation history and watercraft use of the project area. The shallow bay waters of the region have been extensively used by an assortment of small watercraft and continue to be traveled by a variety of commercial fishing and oil and gas industry vessels, barges and smaller recreational craft. However, the project area itself does not seem to have ever been the locus of intensive vessel activity. It is not located along any of the historic routes leading into or out of the several navigable bayous entering Terrebonne Bay and there is no evidence that it ever supported historic settlement or a docking facility of any kind. A review of landform changes in the region reveals that a large portion of the project area is likely to have been "fast land" just 100 years or so ago and parts of the project area were marsh and/or natural levee landforms until quite recently. The project area has become entirely open water only in the past two decades. It appears as if the land in the project area constituted the terminal end of an ancient distributary for some period of time and, as such, served as a "headland" of sorts, known as Point Meshe. The presence of this headland in the project area does slightly increase its potential as a shore against which boats might have been blown and wrecked or where they may have stopped or anchored. But the very small size and isolation of Point Meshe argues against any serious concentration of vessels visiting or foundering there.

The remote-sensing survey did record a number of small, discreet magnetic anomalies in the project area. These tended to be concentrated in the eastern quarter of the area, near the Houma Navigation Canal. These small magnetic targets are believed to represent, in the main, modern trash and debris lost or thrown from passing vessels. It is not surprising that these objects tend to concentrate near the navigation canal, where commercial boat traffic has been and continues to be most intensive. These findings are not unlike those reported from other similar settings where modern usage of a waterway or water body is high. For example, Pearson (1987) recorded numerous, small magnetic anomalies in the Laguna Madre near Port Isabel, located on the extreme southern Texas coast. The anomalies were concentrated in an area heavily used by small boat traffic and it was argued that the magnetics were largely the result of modern debris lost or thrown from boats. More direct equivalents to the present study are results from recent surveys in Cat Island Pass, just a few miles south of the project area (Birchett and Pearson 1998); Aransas Pass and the Corpus Christi and La Quinta Ship

Channels in Texas (James and Pearson 1991, Pearson and Simmons 1995), and from Mobile, Pascagoula, Galveston and Matagorda bays, where modern commercial vessel traffic is fairly high (Irion 1986; Mistovich and Knight 1983; Mistovich et al. 1983; Pearson and Hudson 1990). In remote-sensing and diving studies conducted in these settings, modern debris was abundant and constituted the bulk of the magnetic signatures recorded. In one study in Mobile Bay, Irion (1986) reported that all of the magnetic anomalies that were investigated by divers were modern debris, much of it consisting of discarded steel cable. Birchett and Pearson (1998) report similar findings along the dredged Houma Navigation Canal through Cat Island Pass.

The difficulties of differentiating between modern debris and shipwrecks on the basis of remote-sensing data have been discussed in the preceding chapter. This is particularly true of magnetic data. There is no doubt that the only positive way to verify a magnetic source object is through physical examination. However, the size and complexity of a magnetic signature does provide a usable key for distinguishing between modern debris and shipwreck remains (see Garrison et al. 1989; Pearson and Hudson 1990). Specifically, the magnetic signatures of shipwrecks tend to be large in area and tend to display multiple magnetic peaks of differential amplitude. Modern debris (at least individual pieces of debris), on the other hand, is more apt to produce magnetic signatures that are small in area and display single magnetic peaks or multiple peaks of similar amplitude. All of the magnetic signatures recorded during the present survey manifest these latter characteristics. The one target selected for additional investigation, Target 1, exhibited only minimal characteristics of known shipwreck magnetics. Additional remote-sensing survey over this target suggests that it is a single, small object, probably modern trash and debris, or, possibly, the United States Geological bench mark that had been established at Point Meshe.

Pearson and Hudson (1990:40) have argued that the past and recent use of a water body must be an important consideration in the interpretation of remote-sensing data; in many situations the most important criteria. Unless the remote-sensing data or the historical record of known wrecks provide compelling and overriding evidence to the contrary, it is believed that the history of vessel use of an area should be a primary consideration in interpretation. What constitutes "compelling evidence" is, to some extent, left to the discretion of the researcher; however, in a setting such as Terrebonne Bay, where oil and gas facilities are common and where modern commercial traffic and fishing activities have been intensive, the presence of a large quantity on modern debris scattered across the bay floor must be anticipated. Many of the vessels operating in the bay, such as shrimp boats, travel almost everywhere the water is deep enough to run, such that some debris will be scattered throughout the bay. However, debris will be concentrated along channel rights-of-way and it will normally appear on remote-sensing records as discrete, small objects. This is exactly the pattern observed in the remote-sensing records obtained in the project area. In the present instance, the pipelines crossing at the northern end of the project area, also, represents an area where debris has probably concentrated as a result of activities associated with installation and maintenance of the pipelines and the pilings marking them.

The proposed island creation area examined in this study represents only one of three planned for construction along this section of the Houma Navigation Canal. The locations of these other two island creation areas are shown in Figure 4-1. The information collected in this study does permit a reasonable assessment of the shipwreck potential for these two areas. One of the areas is to be located on the west side of the navigation canal about 3,000 ft south of the present project area. The geological information collected here suggests that this southern island creation area has been open water for a longer period of time than the present project area. It lies south of the farthest extension of the Point Meshe Distributary, at least as it existed in the late nineteenth century. However, there is no evidence that this southern area lay astride or near important navigation routes. Further, no known shipwrecks are reported within the

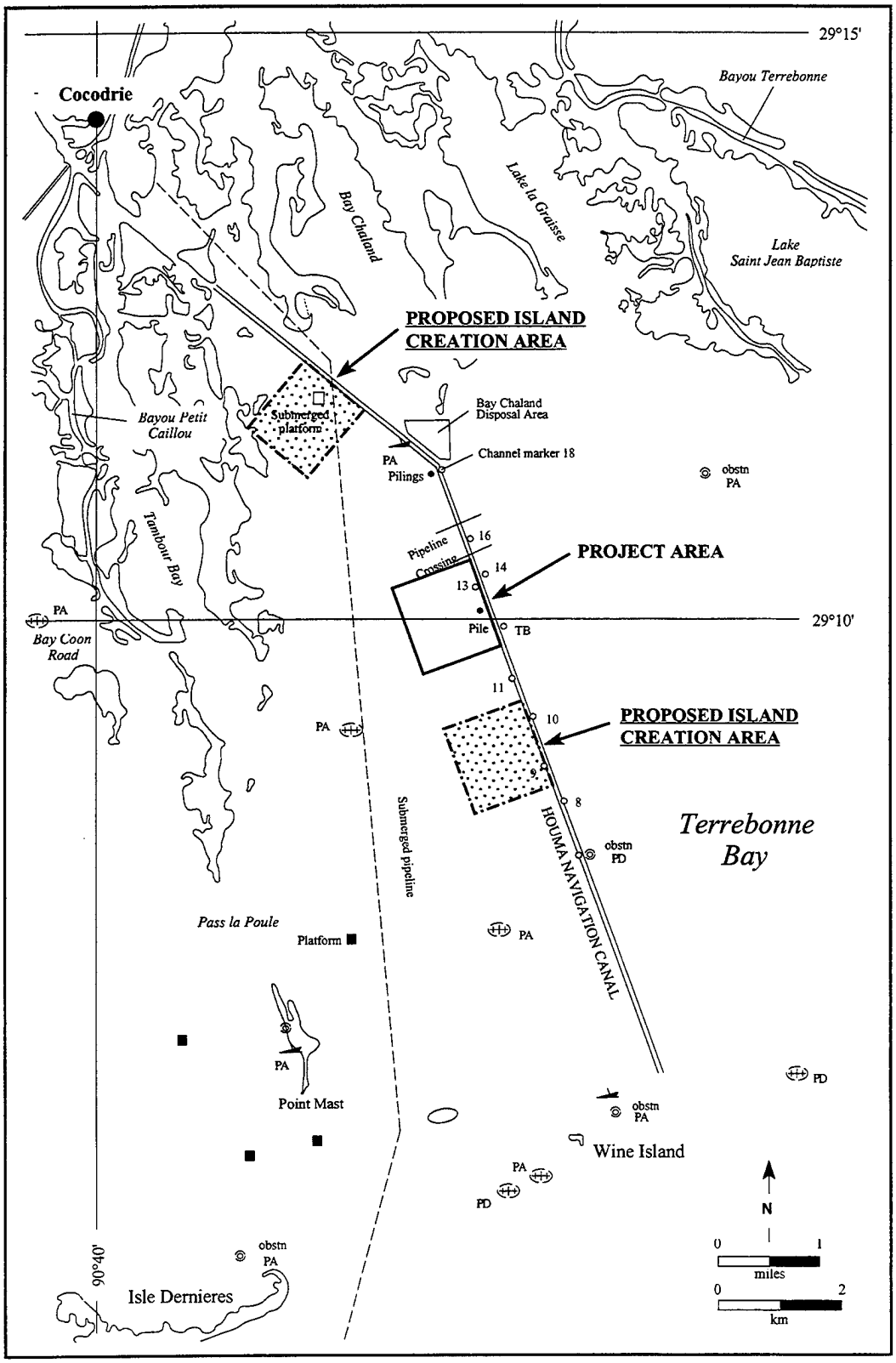

Figure 4-1. The locations of proposed island creation areas.

boundaries of this area. Based on the information collected here, it is believed that the wreck potential of this southern area is low, similar to that of the present project area.

The other proposed island creation area is to be located approximately two miles northwest of the present project area (see Figure 4-1). The geological information collected indicates that until very recently the western portion of this area was occupied by marshlands extending off of the eastern side of the Bayou Petit Caillou distributary. Both the 1909 and 1983 topographic maps of the area indicate exposed marsh landforms occupying the western quarter or so of this area (USGS 1909, 1983). The eastern three-quarters of this area appears to have been open water since, at least, 1900. It is unknown how far in the past this open water setting existed, but it is expected that a considerable portion of this northern area was marsh prior to 1900. There is no evidence that any important navigation route passed through or near this area prior to the construction of the Houma Navigation Canal in the early 1960s and no wrecks are reported from this area. Therefore, it appears as if the historic shipwreck potential of this island creation area is low.

Figure 4-1 does, however, show two cultural features within this northern area that might constitute hazards during the construction of the artificial island. These are a submerged pipeline and a reported "submerged platform," presumably an abandoned and collapsed oil or gas well location. The pipeline is an 8-in line owned by Ocean Drilling and Exploration Company. The New Orleans District is aware of this pipeline and their construction plans show that it is deeply buried, lying at an elevation of -30 ft MLG. This appears to be the depth of the pipeline where it crosses under the Houma Navigation Canal; it is unknown if this pipeline maintains this depth through the entire construction area. The submerged platform shown on the 1998 NOAA navigation chart is not shown on the construction plans developed by the New Orleans District. It is possible that this platform has been removed in recent years, however, if it hasn't it could represent an impediment, if not a hazard, to the construction proposed here.

Recommendations

None of the targets recorded in the project are believed to represent significant cultural remains and no further examination of the area for wrecks is considered necessary. Research into the geomorphic history of the project area does suggest that subsided natural levees of what has been named the Point Meshe Distributary may be buried beneath the project area. Prehistoric archaeological sites tend to be associated with natural levees and there is a very slight possibility that prehistoric remains did exist on these levee features prior to their subsidence and submergence. However, it is anticipated that any prehistoric components associated with Point Meshe Distributary levees at this location are likely to have been destroyed or seriously disturbed by erosion. Further, if intact, buried natural levee features do exist here, they are expected to be covered by as much as 6 ft or so of recent bay bottom sediments. The dredging proposed for this area is only to achieve the depth required to move rock-laden barges from the navigation canal to the island location. It is unlikely that this dredging will extend deep enough to impact any natural levee features that may exist. Therefore, no additional work relative to prehistoric sites is considered necessary.

The project area yielded no evidence of historic vessel remains. In light of the information collected on the navigation and geological history of the project area, this is not too surprising. The project area does not lie near the principal historic water routes through Terrebonne Bay and, thus, has never been the locus of intensive vessel activity. However, this fact does not preclude the possibility that wrecks may exist in other, unsurveyed, portions of Terrebonne Bay. Many areas in the region will have a much greater probability of containing historic vessel remains than the present project location. These would include areas close to or within the passes leading from the bays to the Gulf, areas near the historic entrances and along

the routes of the principal navigable waterways, and areas in the vicinity of historic landings and settlements. All of these types of settings have a moderate to high probability of containing the remains of ships and boats that have been accidentally lost as well as those that have been purposefully abandoned. Future cultural resources studies in the region should consider these factors in the implementation and design of remote-sensing surveys whose principal purpose is to find historic shipwrecks.

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REVISED SCOPE OF SERVICES
Contract DACW29-97-D-0017
Delivery Order 17

REMOTE SENSING CULTURAL RESOURCES SURVEY
OF THE HOUMA NAVIGATION CANAL DREDGE ISLAND CREATION PROJECT,
BETWEEN MILE 11.0 AND MILE 0.0,
TERREBONNE PARISH, LOUISIANA.

1. Introduction

This delivery order calls for a remote sensing survey and anomaly testing for underwater cultural resources west of the Houma Navigation Canal (HNC) Terrebonne Bay, Louisiana. The U.S. Army Corps of Engineers, New Orleans District (NOD) plans to create a beneficial use disposal area through the placement of shoal material excavated from the Mile 11.0 to Mile 0.0 reach of the HNC during routine maintenance dredging (Attachment 1). Approximately 100 acres of open shallow water would be designated as a beneficial use disposal site. Shoal material would be removed from the navigational channel during routine maintenance of the waterway and would be placed in the disposal area to a height conducive to the development of barrier island habitat. In conjunction with the disposal activities, retention dikes would be required to prevent both the erosion of the placed material and the flow of the material back into the navigational channel. Rock, earth, shell, or a combination of the above material would be used for dike construction or refurbishment. The disposal area is located in Terrebonne Bay 1000 feet from the western side of the HNC opposite Mile 5.8. The disposal area would be approximately 100 acres in size. Excavation of a flotation channel to permit rock-carrying barges access to the work site would be performed by bucket dredge. The flotation channel would be 1,000 feet in length. Additional details on the project are provided in Sections 2, 3 and 4, below. The contract period for this delivery order is 32 weeks.

2. Project Area

The project area is located just west of the HNC in Terrebonne Bay (see Attachment 1). Approximately 100 acres of water bottom will be affected by the creation of the disposal island and the dredging of the flotation channel.

3. Background Information

A consideration of cultural resources was included in NOD's 1975 report entitled *Composite Environmental Statement for Operation and Maintenance Dredging of Four Projects Located South of the Gulf Intracoastal Waterway in Terrebonne Parish, Louisiana.* An inventory of shipwrecks and other waterborne resources surrounding the HNC was completed by Pearson, et al. (1989). The wreck of the ca. 1858 *Afton Jr.* was reported on the west side of the navigation channel near Mile 0. The *Thistle* is reported to have wrecked east of the HNC in 1887. The *Lizzie Haas* is reported to have sank just west of the project area in 1902. There is a potential for encountering remains of shipwrecks or other underwater cultural resources within the project area.

In 1998 a study entitled *Underwater Survey of the Houma Navigation Canal, Cat Island Pass Channel Realignment* was completed by Coastal Environments Inc. This study covered approximately 3.5 miles of channel. Twenty targets were located during the survey. Four of the targets were of sufficient mass and shape to warrant further study. These anomalies were investigated using probing and diving. None of the areas was found to contain significant cultural resources.

4. General Nature of the Work

The purpose of this study is to locate significant historic shipwrecks or other underwater cultural resources which may exist in the project area. The study will employ a systematic magnetometer, side-scan sonar, and bathymetric survey of the study area using precise navigation control. All magnetic and sonar anomalies will be interpreted based on expectations of the character of shipwreck signatures. All potentially significant anomalies located by the survey will be investigated by more intensive survey. This will include additional, more tightly spaced, transects and possibly probing. After preliminary analysis, a consultation meeting will be held with COE archaeologists to determine if any further testing will be necessary. Based on the preliminary analysis and consultation meeting, up to two anomalies may be further investigated by diving and possibly some excavation.

5. Study Requirements

The study will be conducted utilizing current professional standards and guidelines including, but not limited to:

(the National Park Service's National Register Bulletin 15 entitled, "How to Apply the National Register Criteria for Evaluation";

(the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation as published in the Federal Register on September 29, 1983;

(Louisiana's Comprehensive Archaeological Plan, dated October 1, 1983;

(the Advisory Council on Historic Preservation's regulation 36 CFR Part 800 entitled, "Protection of Historic Properties";

(the Louisiana Submerged Cultural Resource Management Plan published by the Division of Archaeology in 1990.

(the U.S. Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1 Dated September 3, 1996.

The study will be conducted in four phases: Review of Background Sources, Remote Sensing Survey, Anomaly Evaluation, and Data Analyses and Report Preparation.

a. Phase 1: Review of Background Sources. This phase is limited to research of available literature and pertinent historical, archival, geomorphological and nautical maps and records contained in existing documents. A navigational history and an inventory of known shipwrecks in the study area is provided in the report entitled *A History of Waterborne Commerce and Transportation within*

the U.S. Army Corps of Engineers, New Orleans District and an Inventory of Known Underwater Cultural Resources prepared by Coastal Environments, Inc. (1989).

The focus of this work will be to identify available information on shipwrecks recorded in the project vicinity, identify historic and modern navigation hazards or other anomalies or features which might relate to significant underwater resources. The background work will provide a context for interpreting anomalies which may be discovered during the course of the survey. The contractor is expected to rely heavily on the recently completed literature search and records review completed for *Underwater Survey of the Houma Navigation Canal, Cat Island Pass Channel Realignment* (Coastal Environments Inc. 1998) in order to minimize duplication of work and minimize project cost.

b. Phase 2: Remote Sensing Survey. Upon completion of Phase 1, the contractor shall proceed with execution of the remote sensing fieldwork. The equipment array required for this survey effort is:

(1) a marine magnetometer
(2) a positioning system
(3) a side-scan sonar system
(4) a fathometer.

The survey will include approximately 450 acres (Attachment 2). The area is inside boundaries drawn by joining the following Louisiana State Plane (NAD 1983) coordinates:

Area 1 (HNC Mile 5.8)
1) x=3513100.00, y=246298.00
2) x=3514721.00, y=241860.00
3) x=3510779.00, y=240418.00
4) x=3509155.00, y=244853.00

The following requirements apply to the survey:

(1) transect lane spacing will be no more than 100 feet.
(2) positioning control points will be obtained at least every 100 feet along transects,
(4) background noise will not exceed +/- 3 gammas,
(5) magnetic data will be recorded on 100 gamma scale,
(6) the magnetometer sensor will be towed a minimum of 2.5 times the length of the boat or projected in front of the survey vessel to avoid noise from the survey vessel,
(7) the survey will utilize the Louisiana State Plane Coordinate System,
(8) additional, more tightly spaced, transects will be run over all potentially significant anomalies.

Two copies of a brief management summary will be submitted to the COR within two weeks after completion of the fieldwork (eight weeks after award). Additional requirements for the management summary are contained in Section 6 of this Scope of Services.

Upon completion of the management summary, a meeting will be held between the Principal Investigator and COE archaeologists. This consultation meeting

will be held within one week of the completion of the management summary. The purpose of the meeting will be to determine which (if any) anomalies will be further evaluated. Up to two anomalies may be further evaluated using diving, probing and possibly some excavation.

c. Phase 3: Anomaly Relocation, Verification, and Evaluation. Following consultation with COE Archaeologists a selection of up to two anomalies will be chosen for further investigation. This investigation will commence with the relocation and verification of anomaly locations. This will require diving and possibly some excavation. The methods shall include, and are not limited to, physical search of the water bottom at anomaly locations, use of metal detector, probing to locate buried sources, and hydraulic jet excavation, if necessary, to uncover anomaly sources.

For any anomaly classified as a site, the Contractor will file state site forms with the Louisiana State Archaeologist and cite the resulting state-assigned site numbers in all draft and final reports. All sites recorded in the project area will be recorded to scale on the appropriate 7.5 minute quadrangle.

Site recordation will consist of hands-on examination, including measuring and mapping each site. Maps will include site boundaries, control point locations, feature and artifact locations, excavation areas, and prominent natural and cultural features in the site area.

c. Phase 4: Data Analyses and Report Preparation. All data will be analyzed using currently acceptable scientific methods. The post-survey data analyses and report presentation will include as a minimum:

(1) post-plots of survey transects and data points;
(2) same as above with magnetic data included;
(3) plan views of all potentially significant anomalies showing transects, data points and contours;
(4) correlation of magnetic, sonar, and fathometer data, where appropriate.

The interpretation of identified magnetic anomalies will rely on expectations of the character (i.e. signature) of shipwreck magnetics derived from the available literature. Interpretation of anomalies will also consider probable post-depositional impacts and the potential for natural and modern, i.e. insignificant, sources of anomalies. The Contractor will file state site forms with the Louisiana State Archeologist and cite the resulting state-assigned site numbers in all draft and final reports for any anomaly classified as a site.

The report shall contain an inventory of all magnetic anomalies recorded during the underwater survey, with recommendations for further identification and evaluation procedures when appropriate. These discussions must include justifications for the selection of specific targets for further evaluation. The potential for each target or submerged historic property to contribute to archeological or historical knowledge will be assessed. Thus, the Contractor will classify each anomaly as either potentially eligible for inclusion in the National Register, or not eligible. The Contractor shall fully support his recommendations regarding site significance. The report will include a summary table listing all anomalies. At a minimum, the tables will include the

following information: Project Name; Survey Segment/Area; Magnetic Target Number; Gammas Intensity; and Target Coordinates (Louisiana State Plane). Recommendations for equipment and methodology to be employed in future evaluation studies must be discussed in detail.

An additional section of the report will be dedicated to detailing anomaly evaluation and testing (if any). The report will provide the assessment of potential significance (in terms of National Register criteria (contained in CFR 60.4) and recommendations for further work. The Contractor shall fully support his recommendations regarding site significance. The Contractor shall also recommend detailed and appropriate mitigation measures for all sites classified as eligible.

If determined necessary by the COR, the final report will not include detailed site location descriptions, state plane or UTM coordinates. The decision on whether to remove such data from the final report will be based upon the results of the survey. If removed from the final report, such data will be provided in a separate appendix. The analyses will be fully documented. Methodologies and assumptions employed will be explained and justified. Inferential statements and conclusions will be supported by statistics where possible. Additional requirements for the draft and final report are contained in Section 6 of this Scope of Services.

A product to be provided under this delivery order and submitted with the draft reports will include CAD design files compatible with the NOD Intergraph system and the NOD provided base map design files. The files will use the same settings and precision as the seed file for the NOD base map .dgn file. In addition to the information specified above, the survey coverage area, the locations of all anomalies and other pertinent features such as: channel beacons and buoys, cables and pipeline crossings, etc. are to be included on the map.

6. Reports

a. Management Summary Two copies of a brief management summary which presents the results of the fieldwork will be submitted to the COR within two weeks of completion of the fieldwork (eight weeks after award). The report will include a summary table listing all anomalies, a brief description of each anomaly located during the survey, and recommendations for further identification and evaluation procedures when appropriate. A preliminary map will be included showing the locations of each anomaly.

b. Draft and Final Reports Five copies of a draft report integrating all phases of this investigation will be submitted to the COR for review and comment within 14 weeks after the date of the award. Completed state site forms will be submitted under separate cover at the same time as the draft report. The final report shall follow the format set forth in MIL-STD-847A with the following exceptions: (1) separate, soft, durable, wrap-around covers will be used instead of self covers; (2) page size shall be 8-1/2 x 11 inches with 1-inch margins; (3) the reference format of American Antiquity will be used. Spelling shall be in accordance with the U.S. Government Printing Office Style Manual dated January 1973.

The COR will provide all review comments to the Contractor within 8 weeks after receipt of the draft reports (22 weeks after date of order). Upon receipt of the review comments on the draft report, the Contractor shall incorporate or resolve all comments and submit one preliminary copy of the final report to the COR within 4 weeks (26 weeks after date of order). Upon approval of the preliminary final report by the COR, the Contractor will submit one reproducible master copy, one copy on floppy diskette, 30 copies of the final report, and all separate appendices to the COR within 32 weeks after date of order. A copy of the Scope of Services shall be bound as an appendix with the Final Report. The Contractor shall also supply a complete listing of all computer files submitted. This listing will include file names, file types, disk number, and file description.

7. Weather Contingencies

The potential for weather-related delays during the survey necessitates provision of one weather contingency day in the delivery order. If the Contractor experiences unusual weather conditions, he will be allowed additional time on the delivery schedule but no cost adjustment.

8. Attachments

Attachment 1. Map showing general study area.
Attachment 2. Plan map of survey location.